A Comparative Study of Mobile Internet Deployment Models in New Zealand

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Mobile Internet is 'anywhere-anytime' Internet

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Abstract

Internet services play an increasingly important role in modern society. Mobile Internet, a fast-growing technology that combines the Internet with mobile devices, has recently become popular.

It is predicted that the convergence between mobile networks and the Internet would become the next generation of network architecture, and mobile IPv6 is likely to emerge as the most efficient and cost-effective instrument to achieve “anywhere and anytime” fast Internet and resolve the problems of worldwide mobility management.

This research project reviews mobile Internet competition and the market mix in New Zealand, both major players and minor players being involved. The researcher also investigates the requirements of the mobile Internet deployment model from two perspectives: the market and the consumers. Finally the connection between end user services (for example, mobile Internet) and convergence (for example, network convergence and technology convergence) are examined in the research study conducted.

The researcher applies a multi-case study strategy to conduct the research project and interview is adopted as the major research technique in order to collect research data. Several organizations which deploy mobile Internet services in New Zealand are chosen as participants, with the aim of offering both personal insights and business views to the research questions and objectives.

Statement of Originality

‘I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person or material which has been accepted for the qualification of any other degree or diploma of a university or other institute of higher learning.’

Yiwen Huang (Raymond)

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List of Abbreviations

1. **TCP/IP:** Transmission Control Protocol/Internet Protocol
2. **IPv4:** Internet Protocol version 4
3. **IPv6:** Internet Protocol version 6
4. **NGN:** Next Generation Network
5. **DSL:** Digital Subscriber Line
6. **ADSL:** Asymmetric Digital Subscriber Line
7. **PSTN:** Public switched telephone network
8. **DSLAM:** Digital Subscriber Line Access Multiplexer
9. **VPN:** Virtual Private Network
10. **LAN:** Local Area Network
11. **WLAN:** Wireless Local Area Network
12. **ISP:** Internet Service Provider
13. **GSM:** Global System for Mobile Communications
14. **GPRS:** General Packet Radio Services
15. **CDMA:** Code Division Multiple Access
16. **W-CDMA:** Wideband Code Division Multiple Access
17. **UMTS:** Universal Mobile Telecommunications Service
18. **HSDPA:** High Speed Downlink Packet Access
19. **HSUPA:** High Speed Uplink Packet Access
20. **3GPP:** 3rd Generation Partnership Project
21. **DS-CDMA:** Direct sequence code division multiple access
22. **TDD-UMTS:** Time Division Duplexing / Universal Mobile Telecommunications Service
23. **EV-DO:** Evolution-Data Only
24. **LLU:** Local Loop Unbundling
25. **FMC:** Fixed-Mobile Convergence
26. **WiFi:** Wireless Fidelity

27. **WiMax:** World Interoperability for Microwave Access
28. **3G:** Third Generation
29. **4G:** Fourth (Future) Generation
30. **VoIP:** Voice over Internet Protocol
31. **TVoIP:** Television over Internet Protocol
32. **GPS:** Global Positioning System
33. **PBA:** Parking Brake Applied
34. **QoS:** Quality of Service
35. **QoP:** Quality of Performance
36. **ICT:** Information and communications technology
37. **OECD:** Organization for Economic Cooperation and Development
38. **DS:** Digital Strategy
39. **SIU:** Services Interface Unit

Chapter 1: Introduction

In information systems and information technology academic literature ‘mobile Internet’ is commonly defined as the part of the current stationary Internet that can be accessed from a mobile device for instance, a mobile phone, a Personal Digital Assistant (PDA), or a laptop (Ghosh et al, 2005; Ott, 2006; Roberts & Kempf, 2006). This definition focuses on user mobility as a main condition. It also suggests that mobile Internet deployment models need to take into account customer demand for access to the current stationary Internet and the services offered via the Internet platform not only ‘anytime’ but also ‘anyplace’ (Schmeck, Ungerer & Wolf 2002, p.4). Mobile Internet can offer a range of new services specifically targeting mobile users, such as paid content (Kaspar et al, 2006), where stationary Internet and the mobile network provision models converge to a significant degree. It is predicted that the convergence between mobile networks and the stationary Internet will be a prominent feature of next generation network architectures (Schwefel, 2002). Some literature (Xavier & Ypsilanti, 2007; Blackman, 2006; Henten, Samarajiva & Melody, 2003) points out that the mobile Internet industry may follow a number of directions:

- Internet Service Providers (ISPs) may start supplying mobile Internet and wireless broadband services;
- The mobile Internet may facilitate the development of Internet-based applications specifically requiring mobile access to the Internet;
- ‘Anywhere-anytime’ mobile Internet services may be made available to both stationary Internet users and to mobile-network users;
- Mobile Internet services and stationary Internet services may start running on a converged network platform.

This research project intends to examine whether the above possibilities could happen in New Zealand and what their impact might be. This is the initial motivation of the research project.

1.1 Research Motivation

According to the past experience, Internet services were served by the service providers through the telecommunication infrastructures (for example, copper line and fiber); then everyone followed the requirements of the 'best deployment model' in offering fixed line Internet services and providing 'free access' to the applications. When mobile Internet is involved, Internet access of the mobile network users becomes another part in the area; also the roles and responsibilities of the services providers are changed.

Most of the previous academic research is focused mainly on the technical issues and users; the requirements and the impact of mobile Internet deployment were not clearly identified; therefore, proposing the required features (business and technological) of the 'most appropriate' mobile Internet deployment model is considered as the primary motivation in conducting this research project.

No previous study was found which systematically investigates mobile Internet deployment in New Zealand. Although some studies examine mobile Internet deployment, in other countries; the researcher believes that the research results of those studies cannot be entirely applied to New Zealand, because the New Zealand market is competitive and unique. As a consequence, it is valuable to conduct research specifically in New Zealand and this is a significant motivation of the researcher.

On the other hand, in terms of technological determinism, mobile Internet is currently well accepted and adopted in some countries for example, United States, United Kingdom and Japan. In New Zealand, companies like Telecom and Vodafone are starting to offer mobile Internet services over their 3G mobile networks at the present time. The researcher assumes mobile Internet deployment is consumer driven, thus the researcher, in addition tries to find out how consumers will choose to use mobile Internet in New Zealand.

This research project intends to draw a picture of the capitalistic environment in New Zealand. This research project may be attractive to industry players in New Zealand market because it will examine customers' needs and proposes mobile Internet deployment strategies that will meet users' demands; the most suitable mobile Internet deployment models will identified based on both technical perspectives and business perspectives. For further investigation there is a potential to compare the New Zealand results with other countries and find out if mobile Internet deployment will have a different impact in other countries.

1.2 Research Objectives

The research project sets itself the goal of investigating the prevailing directions in the deployment of mobile Internet in New Zealand and to provide recommendations for its future development. So, based on mobile Internet deployment models, there are four research objectives built especially for a New Zealand perspective:

- Obtain an in-depth picture of the telecommunication sector in New Zealand and examine the value chain between service providers and consumers.
- Investigate the shift from fixed-line broadband and mobile-wireless broadband, and the impact of the shift.
- Investigate the requirements of mobile Internet deployment in the New Zealand market and its consumers;
- Examine the connection between mobile Internet and convergence process (network and technology);

The four research objectives presented above are essentially related to mobile Internet deployment. Through accomplishing those objectives, the researcher also looked at future trends (for example, network, technology and end-user service) and defined the requirements of the mobile Internet deployment model most suitable for New Zealand.

1.3 Thesis Outline

This study consists of eight sections:

- ***Chapter 1 - Introduction***: briefly introduces the research topic and research context.

- ***Chapter 2 - Literature Review:*** provides a concise overview of relevant work.

- ***Chapter 3 - Research Background:*** describes the mobile Internet industry segment in New Zealand.

- ***Chapter 4 - Research Methodology:*** builds the research framework, research questions, data collection method and data analysis method.

- ***Chapter 5 – Case Review:*** reviews the main points of the interviews.

- ***Chapter 6 – Case Findings:*** summarizes the research findings, which will be supportive of the research questions from the case review.

- ***Chapter 7 – Analysis and Discussion:*** endeavors to answer the research questions from the findings using literature as support.

- ***Chapter 8 - Conclusion:*** draws implications and recommendations from the research project.

1.4 Opportunities and Limitations

Mobile Internet is a fast developing service in the telecommunication sector. Mobile Internet is not only a service offered to end users, but also a critical success factor that essentially contributes to the network convergence process. This research project is an

industry report. Mobile Internet service providers will be interested in the research outcomes because the service providers can obtain environmental opportunities for their deployment models.

However, there are some limitations to the conducted research project:
Geographic area: the research aims to investigate mobile Internet deployment models in New Zealand; therefore the results may only be applicable within this particular geographical area.

***Participants*:** eight organizations were chosen as participants; however only five participants agreed to be involved in the study. The five participants are the most prominent companies in New Zealand, and the numbers of participants meet the research scope.

Research outcomes: there are three research questions in this study; the participants provided extensive answers and discussion on both Questions 1 and 2, however there was little opinion that related to Question 3. The major reason for this is that participants show strong interest in Questions 1 and 2, but less interest in Question 3. However, the researcher can still find relevant answers to Question 3 from the research findings and the interviews, but with information too limited for a creditable discussion.

1.5 Conclusion and Recommendations

By studying the mobile Internet and its impact on the telecommunication sector, the next step in research would be to investigate how mobile Internet could cooperate with other sectors, for instance the government (mobile-government), the health sector (mobile-health), the financial sector (mobile-banking) and so on. Since mobile Internet is itself a service that enables fast Internet on mobile phones, a wide range of services will become accessible and popular with the availability of mobile Internet.

Chapter 2 Literature Review: Main Mobile Internet Research Areas

As defined above, the present mobile Internet is a simplified subset of the stationary Internet and is therefore similar to it. However there are important differences related to access: for instances, free stationary Internet, subscription based mobile Internet. This in turn affects the usage and the adoption of mobile Internet. Further, the technologies through which the mobile Internet can be delivered to the consumer vary across a range of deployment models, based on the characteristics of the specific network architecture implemented (for example, CDMA / W-CDMA, WiFi, WiMax). In comparison, the stationary Internet is still operating on the TCP/IP protocol stack, which ensures that technology implemented at lower layers of the stack is transparent to upper layers and to the applications using the network.

Table 1: Mobile Internet research areas

Layer search	Description	Themes
Adoption and acceptance	Studying user attitudes, critical success factors for user adoption of mobile devices, user intention to use and acceptance of the mobile Internet services.	Identifying application and service specific factors influencing intention to use The role of identified critical success factors in models used to study adoption of the stationary Internet
Deployment and management models	Problems related to implementing the protocols and technologies in practical terms and the issues arising.	Successful implementations Value chain models Profit sharing models Business models
Protocols and technologies	Perspectives on the performance, applicability and interoperability of protocols and technologies enabling mobile Internet.	Improved performance Mobility support at all layers of protocol stack Quality of service Global mobility and interoperability

These specific features of the mobile Internet have determined the main direction of academic research in the area. Expanding on the classification of mobile commerce research direction suggested in Okazaki (2005), three main clusters of research in the area of the mobile Internet can be identified (Table 1).

2.1 Mobile Internet Adoption and Acceptance

Work on mobile internet adoption and acceptance focuses on the end user who is viewed as the consumer of the mobile Internet through services and applications offered and is the heart of the customer-centric mobile Internet industry segmentation model (Soininen, 2005).

Consequently, research focuses predominantly on adoption. Studies investigating the impact of mobility- or platform-specific features on the intent to adopt a service (Chae & Kim, 2003; Brown et al, 2003; Kleijnen, Wetzels & Ruyter, 2004; Petty, 2003; Bertelé, Rangone & Renga, 2002) identify a variance in the adoption rate for services within business domains (for example, banking, financial services, information provision, commercial services such as auctions, entertainment). A study of mobile Internet usability (Kim et al, 2002) similarly indicates that the adoption of a service or an application also depends on specific user context (for instance, a free hand available to operate the mobile phone).

Frameworks used to investigate stationary Internet services adoption (for example, TAM, TRA, TPB) are adapted and applied in a number of studies (Hung, Ku & Chang, 2003; Lu at al, 2003; Nysveen, Pedersen & Thorbjornsen, 2005; Forster & Tang, 2006); an example of an empirical investigation based on a diffusion of innovation model is provided in Wang, Ku & Doong (2007).

A few investigations on mobile Internet users' adoption decisions and service acceptance are found in Fogelgren (2005), Pederson (2005), and Pedersen & Ling (2003). Naruse (2003) conducts a survey study on mobile commerce, which is

concerned with mobile Internet usage and awareness. Urbaczewski et al (2002) point out how culture differences essentially influence the adoption of mobile Internet services.

Mobile Internet has become more popular with consumers, thus it is valuable to examine the adoption process and its impact. While investigating the adoption process of mobile Internet services, just as with any new technology or service, performance and usability are both significant factors (Buchanan et al, 2001). Cho, Byun and Sung (2003) conduct a research project, which investigates the impact of broadband on user behavior, and its research outcomes are very relevant to the examination of user behavior of mobile Internet.

Based on the acceptance of mobile Internet users, a wide range of end-user services have recently become popular. Location-based mobile services have been investigated in much academic research (Jensen et al, 2002; Tayal, 2005; Saab & Kabbout, 2002; Requena, 2002; Soliman, 2000). some research carries out service discovery solutions and context-based solutions based on mobile Internet accessibility (Tyan & Mahmoud, 2005; Masri & Mahmoud, 2006; Bellavista et al, 2006; Corradi et al, 2005,); and Ryan & Gonsalves (2005) and Montanari & Toninelli (2005) are two articles specifically working on usability and acceptance of the service discovery solutions. Moreover, an empirical work (Chakraborty et al, 2005) studies mobile Internet service composition and its interaction with end-users and a user-enabled service management system on mobile Internet has been proposed in (Fodil, 2005).

Back to something people are familiar with, information over internet protocol has currently become well-accepted by end users, for instance Voice Over IP (Meisel & Needles, 2005) is the primary use of mobile Internet; multimedia over IP (Shin et al, 2006) has become available with wideband mobile Internet; furthermore, mobile TV will become popular with end users being able to watch television programs on mobile phones (Knoche & McCarthy, 2005; Yang, Todd & Ou, 2006).

Mobile commerce and mobile business has become more relevant to people's lives, the attraction of custom-made service for users in mobile-commerce and mobile business are investigated (Arbanowski et al, 2004; Ho & Kwok, 2003)

In summary, mobile Internet is just an initial step, which connects Internet services and mobile devices. When mobile Internet becomes readily accepted and available to end users, service providers will build various types of solutions based on mobile Internet, with the purpose of serving the customers' demands.

2.2 Mobile Internet Deployment and Business Models

Research in the areas of mobile Internet deployment and business models is 'scarce', according to Okazaki (2005). A number of works investigate the best-known successful mobile Internet implementation, DoCoMo's iMode and the adoption process related to the services offered in iMode (Baldi & Thaung, 2002; Barnes & Huff, 2003; Okazaki, 2004; Jonason & Eliasson, 2001).

Based on examples for Japan and Finland, Soininen (2005) proposes a comprehensive value network model for the mobile Internet industry segments and concludes that a cooperative model of deployment, across the value chains of the different segments, would have a better chance of success as it would bring value to customers and allow for fair profit sharing among actors in the value chain.

Soininen (2005) points out that the mobile Internet value chain is complex as each segment of the industry (for example,, networks) can be represented by its own multi layered value chain. Adding to the complexity of the interactions, a number of actors in the value chains interact directly with customers (for example ISPs, but also network operators and content providers).

As a network of networks, the global mobile Internet interconnects mobile internets in countries with different legislative and other regulatory environments. Thus, it would seem that investigating the complex area of mobile Internet deployment as a case study as demonstrated in the white paper by Xiangdong (2001) and the postgraduate thesis work by Pikula (2001); both examples provide extensive information about mobile Internet deployment and business models in two Asian countries – China and Japan. Takaaki et al (2003) provide a case study on the mobile Internet deployment called MIAHO.net in Japan, specifically stating requirements that lead to successful deployment; Srivastava (2003) investigates the mobile broadband challenges in a specific geographic area – Iceland, while a WLAN-based mobile Internet deployment case study has been carried out by Choi et al (2003). In fact, the 'anything' deployment process of consists of similar issues and steps and mobile Internet deployment can learn from several related successful deployment process, such as mobile Internet protocol deployment (Chang et al, 2005); Voice Over Internet Protocol deployment (Meisel & Needles, 2005); Television Over Internet Protocol (Knoche & McCarthy, 2005)and mobile communication and broadband deployment (Henten et al, 2004; Leighton, 2001).Some articles mention that mobile Internet has impacted on business strategies, business models and the communication sector (Kallio, Tinnila & Tseng, 2006; Palmberg & Bohlin, 2006; Ballon, 2004; Frieden, 2005; Dodourova; 2003).

Some academic research deals with the requirements of mobile Internet service deployment (Leighton, 2006; Cerf, 2003; Diot et al, 2000). Mobile Internet user behavior is a critical success factor in the deployment models, a methodology to analyze and understand mobile Internet user behavior is proposed in Yamakami (2003a); Resource-allocated and resource-based interdependencies are mentioned in Montalvo, Kar & Maitland (2004), a two-dimensional evolution model of profit-added mobile Internet services has been investigated in Yamakami (2005); an empirical observation of a three-year mobile internet service evolution has been conducted in investigating the mobile Internet service stage models in Yamakami

(2003b). Moreover, the QoS (Quality of Service) is extremely important to mobile Internet deployment (Garcia et al, 2003; Zhigang & Jianping, 2000; Bianchi et al, 2003); and usually the quality of service presents a direct link to users' acceptance and adoption (Maniatis, Nikolouzou & Venieris, 2002; Bouch, Bhatti & Kuchinsky, 2000; Toumi & Duda, 2003) Where the Internet is concerned, connection speed or the bandwidth is a significant requirement (Soldati, Johansson & Johansson, 2006; Kwon et al, 1999; Qiu, Bahl & Adya, 2002) and performance determines whether mobile Internet services can keep clients (Fang, 2005; Lakshminarayana & Padmanabha, 2003).

In summary, 'Deployment' and 'Adopt are firmly connected, while service providers deploy mobile Internet services to users, they should not only deploy something suitable to the market, but also treat users as the most important factor. A deployment model cannot be thought of as 'successful' without getting the 'acceptance' of users, therefore, the most appropriate deployment model should fit the market and meet the customers' expectations.

2.3 Mobile Internet Technologies and Protocols

At the bottom layer of Table 1 (beginning of Chapter 2), research is focused on technologies including cellular networks (for example, 3G/4G technologies and standards) and wireless broadband access such as WiFi (IEEE 802.11), WiMax (IEEE 802.16) aimed at improving performance, coverage and robustness and establishing standards (Ghosh et al, 2005; Saugstrup & Henten, 2006; Santhi & Kumaran, 2006). Research in the area of supporting mobility at the upper layer (Table 1) focuses on developing application layer protocols of sufficient complexity to be capable of dealing with both mobility and interruptions and still provide seamless service to the user (Ott, 2006; Rodriguez et al, 2004). Specific results in mobile IP v4 and v6 are also regularly reported, the research objectives include providing quality of service (Leu & Chang, 2003; Zhu, Li & Duan, 2005), providing mobility management across large geographical locations (Roberts & Kempf, 2006) and across heterogeneous

radio systems (Dutta et al, 2004), establishing standards for mobile TCP/IP (Paila, 2003; Stojcevska & Gusev, 2002; Prasad & Dixit, 2002, p.280), and research which particularly focuses on mobile Internet protocols (Samjani, 2001; Perkins, 1998; Chao, 2001).

Work on the future of mobile Internet has been mentioned as a key factor that drives the convergence of networks, technologies and services (Funk, 2003; Joseph, Lucky & Mohan, 2006; Katz, 1998; Lu, 2000). The convergence of fixed and mobile communications has been examined in Heesvelde (2003) and Curwen (2006); the implications and regulations of convergence has been described in Shin et al (2006), while Nikolaou and Zervos (2006) investigate wireless convergence architecture and describe mobile Internet as a driver of convergence.

The role of mobile Internet in mobile data systems is explored in Guardini, D'Urso & Fasano (2005). Future mobile Internet concepts and issues in the emerging 4G wireless network are introduced in Varshney & Jain (2007) and Agrawal & Famolari (2006) Some investigations focus on future networks and technologies (Thakolsri et al, 2006; Agrawal & Famolari, 2006; Reynolds, 2003).

In summary, mobile Internet is a driver of the convergence process, including network and technology convergence. The Internet and the mobile network will merge in the near future, and this convergence is happening in New Zealand (also worldwide). It is very interesting to predict what will happen in the future, and the mobile Internet is the key that initially opens the door to the convergence process.

2.4 Conclusion and Recommendations

The classification used in the literature review it is rather simplified and does not differentiate strands of research within the three main layers identified. However, it provides a structure for the analysis of the literature and helps position the research

project presented in this paper - a study which focuses on the investigation of mobile Internet deployment models in a particular geo-political area (New Zealand).

The three layers in Table 1 are essentially linked together; the research conducted in this thesis covers all layers of Table 1, but is mainly focused on mobile Internet deployment. The researcher will expand the research area, by linking mobile Internet deployment models to users (for example, user expectation), the market (for example, business models and competition), the technological requirements and convergence (for example, network, technology and service).

Based on the reviewed literatures and the main mobile Internet research areas, the background, design and methodologies of the research will be described in the next two chapters.

Chapter 3: Research Background: The Case of New Zealand

As mentioned before, the primary motivation of conducting this research project is to systematically examine mobile Internet deployment models and their impact on New Zealand; this chapter is the research background and introduces the telecommunication sector and mobile Internet market in New Zealand.

In the 21st Century, the new mobile / wireless era, New Zealand is not a ICT-poor nation, and technology plays a major role in national development. According to Graeme Muller, National Manager of IDC New Zealand, in 2005 New Zealand's ICT industry was ranked an impressive 17th in the list of 53 countries surveyed (Computerworld, 2006a). Broadband usage in New Zealand has increased significantly, with 61% reported growth in the twelvemonth period ending in September 2006 (Geekzone, 2006). This accelerated growth presents both opportunities and challenges to network operators as fixed line Internet provision is no longer the most significant activity of New Zealand ISPs.

As the demand for mobile and wireless access has increased, New Zealand's Internet market has become an attractive test bed platform for global service providers to implement their advanced mobile and wireless Internet innovations. Another feature of the New Zealand environment is the support provided by the Government: its strategic targets indicate that in terms of broadband performance, by 2010 New Zealand should reach the top half of the OECD ranking, and the top quartile by 2015 (Digital Strategy, 2006). The government recommends investment in a range of infrastructures to keep up with the competition and for the most advantageous use of the spectrum available for mobile / wireless broadband technologies. It might therefore be of interest to investigate further the possible move towards the converging of technologies, networks and business models, as the industry players compete in offering value to customers and maximizing the potential of next generation network technologies.

Businesses in New Zealand do not typically consider how mobile technologies could offer conveniences and enhance the productivity in the market; they are not aware of the benefits gained from innovative technologies unless someone tells them. What they care about might be the figures provided by the service providers, such as price, speed of connection, and data allowance.

Mobile Internet is innovative for everyone, even the service providers. Indeed, there is not one mobile Internet solution to suit all the requirements at this stage; no one knows which deployment model is the best solution for mobile Internet development and no one knows if there will be something new to replace the existing technologies.

3.1 From Fixed-line Infrastructure to Mobile and Wireless Infrastructure

The telecommunication and Internet market in New Zealand consists of two main business models: network operators and Internet service providers. The network operators are the major players in the market and the Internet services providers are the minor players that resell the solutions and services of the network operators.

There are four network operators in New Zealand and they have most of the customers in the market. New Zealand's fixed-line broadband is primarily with DSL and the biggest DSL system in New Zealand is covered by ***Telecom*** with its 'copper wires' in the ground; ***Telstra Clear*** has small urban areas of coverage with the ground-based infrastructures, primarily 'fiber'. ***Vodafone*** has its business focused on mobile services; it started its cooperation with iHug (an ISP) in 2005 and entered the DSL competition. ***Vector New Zealand*** is an energy service provider, which owns some fiber networks for telecommunication purposes.

Apart from the network operators and the ISPs who resell the services from the larger players, some companies (for example, Woosh, Call plus) have expanded their services and networks, in order to develop beyond the position of 'reseller'. This

shows that Internet competition has become more serious, especially mobile and wireless Internet competition. The age of a single DSL player – Telecom has ended, and it is likely that the Internet providers will shift the focus from fixed-line to mobile Internet is not only offering opportunities to the country, but also changing in the business models and the market mix.

3.2 Mobile Internet Technologies in New Zealand

The mobile and wireless infrastructures in New Zealand have extended to 3G cellular networks, hot-spots based on WiFi technologies, and wireless broadband WiMax technologies. These three sectors are trying to work out a final solution for mobile Internet development at this stage. However they are not cooperating with each other in some fields and they act individually as a part of the national mobile Internet development solution in the market.

It is difficult to state which infrastructure is the best suited to the government's "Digital Strategy" and the end users' satisfactions, as they all have strengths and weak points. The mass mobile Internet market is playing a role as a large contributor that provides both challenges and opportunities to New Zealand's ICT development.

Cellular network operators are the major mobile Internet distributors, the current 3G cellular networks and the future 4G technology could significantly provide an opportunity to deliver broadband Internet services. At this moment in time, an extensive range of applications and services are available on the existing mobile networks. The operators of the mobile networks are continually working out the best solution to merge their 3G mobile networks with the IP network. These operators are the major players in the market and they concentrate on mobile Internet deployment and the related services, with the purpose of achieving better competitive advantage n the mobile telecommunication market.

WiFi technologies, known as “hotspots” in the commercial world, have been used to deploy wireless broadband over the last few years. The WiFi enabled mobile devices (such as 3G cell phones, PDAs, and laptops) can connect to the Internet-enabled local area networks, and can then receive broadband services. Basically, a single hotspot could only offer wireless broadband connection over a small area. However, as the number of the hotspots increases, a wider area of the WiFi network is built. For instance, service providers set up a large number of hotspots in the CBDs of the major New Zealand cities, and Internet services are available to users anywhere in the central city. Thus, the hotspots services are well-received in public locations and these customer-focused areas.

WiMax (IEEE 802.16 fixed-wireless standard) is a potential technology that could provide higher speed mobile data over a wider coverage range and at a lower cost. WiMax has the edge in terms of higher speed, broader coverage and lower cost to any existing technologies, and it is expected that this innovative technology could deliver both mobile and fixed wireless Internet connectivity. As a consequence, the national mobile Internet service could be built on WiMax technologies. WiMax technology is a “vital issue” after 3G; it stands to replace two different types of wireless broadband technology: fixed wireless technology and mobile wireless. Moreover, Mobile WiMax (a fresh cellular technology) will start competing with the current 3G mobile networks and the existing hotspot WiFi networks in the next few years.

3.3 Mobile Internet Market Overview in New Zealand

Mobile and wireless infrastructure in New Zealand includes 3G cellular networks, ‘hot-spots’ based on WiFi (IEEE 802.11) technology, and wireless broadband WiMax (IEEE 802.16) technologies. The mobile Internet industry segment is represented by two main categories of industry players: mobile network operators and the Internet service providers - ISPs. This section briefly describes the market mix in New Zealand.

The mass market offers both opportunities and challenges to the telecoms companies. Service providers include major and minor operators making up mobile Internet competition in New Zealand. Table 2 below describes the mobile Internet market, deployment methods and operators up to January 2007.

Table 2: Mobile Internet Deployment Overview in New Zealand

Deployment	Operators	Description
Cellular / 3G Wireless Network	Telecom (Network Operator)	Telecom offers 3G broadband over its MC-CDMA (CDMA2000) network, which has been updated to EV-DO Rev A; Rev B will be available in 2008.
	Vodafone (Network Operator)	Vodafone offers 3G broadband over its DS-CDMA (WCDMA or 3GSM) network, which has been updated to HSDPA; HSUPA will be available in 2008.
	Telstra Clear (Network Operator)	Telstra Clear plans to launch the third 3G network in 2007 / 2008. The network is a 2.1GHz UMTS-WCDMA network, with the speed at either HSDPA or HSUPA.
	Woosh Wireless	Woosh Wireless provides wireless broadband services over its UMTS TDD-UMTS wireless network, which is provided by IP-wireless USA. WiMax technology will be considered in the near future.
WiFi - Hotspots	Telecom	Telecom provides hotspot service via its DSL network in many public areas of the country
	City Link	City Link provides hotspots service via its Metropolitan Ethernet Optical Fiber LAN.
	iPass / T-Mobile	iPass / T-Mobile provides hotspots service via its global broadband roaming network.
	FON Community	FON does not have its own network, but it allows individuals (FON members) to share their wireless LAN to

		build a large global WiFi network.
WiMax	Call Plus / Slingshot	Call Plus is planning to build a national WiMax broadband network (2.3GHz) in the coming years, and a WiMax trial is implemented in Whangarei.
	NatCom	Natcom's WiMax Airthernet service is a trial network with WiMax standards in the central city of Auckland.
	NZ Wireless	NZ Wireless is implementing a trial to build a WiMax network with a 3.5GHz license in Wellington and the Hutt Valley

3.3.1 Mobile Networks in New Zealand

New Zealand's cellular network operators are the major mobile Internet providers as well, and therefore, 3G/4G technologies have an important role in the delivery of broadband Internet services. At present, New Zealand has two 3G cellular networks, owned by the two major mobile network operators (Telecom New Zealand and Vodafone). Other operators are intending to enter the mobile market. Telstra Clear is building its own 3G network to gain better competitive advantage and join the mobile competition. Woosh Wireless (an ISP) is cooperating with IPwireless (a leading wireless technology provider in the United Kingdom) and using UMTS-TDD in its deployment of wireless Internet services.

3.3.1.1 CDMA2000 vs. W-CDMA

Telecom New Zealand holds a smaller market in the GSM mobile market. However, it has the largest number of customers in the broadband market, and it shares its network with small ISPs and service wholesalers. Telecom was the first company to launch 3G services on the New Zealand market at the end of 2004. Vodafone was the winner in the GSM mobile market competition, however it was not an Internet service provider until its 3G broadband was available to its mobile users in October 2005. In order to enlarge its business in the fixed broadband market, Vodafone bought iHug

from iNet Australia in October 2006 (Computerworld, 2005a). Due to the market environment, the competition between Telecom and Vodafone has moved from GSM to mobile broadband.

Telecom New Zealand deploys EV-DO mobile and broadband services via its CDMA2000-based network and Vodafone deploys its mobile and broadband services over its 3GSM-WCDMA network. The following diagram illustrates the mobile network evolution between the CDMA2000 technologies and WCDMA technologies and this information is provided by Robert Hart, the National Manager, Australia and New Zealand Qualcomm International at the Convergence 06 Oceania Wireless Event (Hart, 2006).

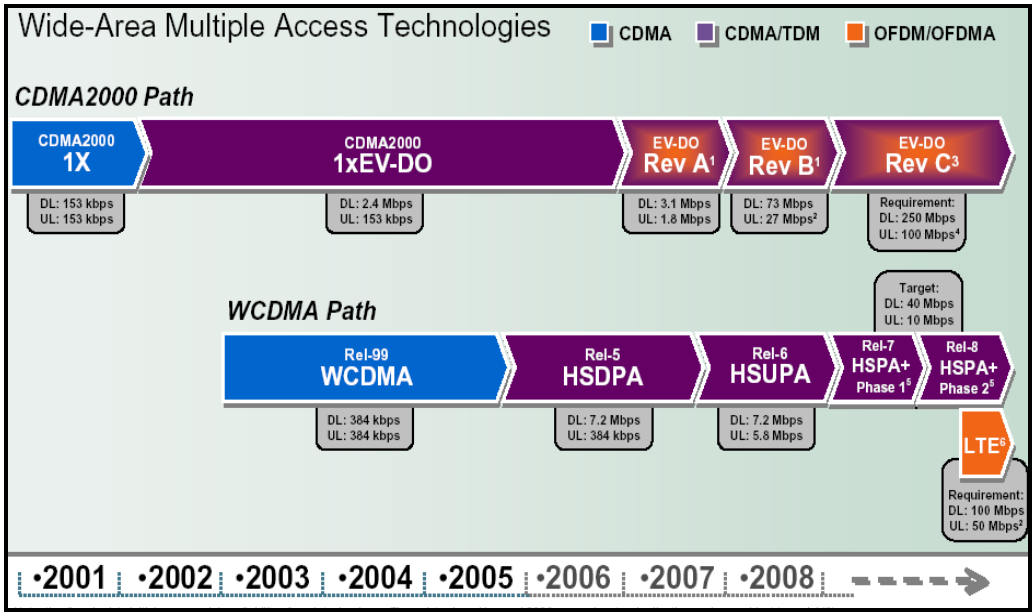


Figure 1: Wide-Area Multiple Access Technologies

Original Source: (Hart, 2006)

Australia and New Zealand Qualcomm International at the Convergence 06 Oceania Wireless Event.

At January 2007, both organizations (Telecom and Vodafone) have upgraded their 3G cellular networks to the newest version, Telecom's EV-DO Rev A technology and Vodafone's HSDPA technology. Although both networks are based on different CDMA paths, they deploy similar 3G services to their mobile users, as well as to

customers with wireless devices such as laptops or smart phones. Those users can use the Telecom Mobile Broadband Data Card or the Vodafone Mobile Connect Card on their wireless devices and gain Internet access via the cellular networks. Moreover, the cellular networks could offer mobile broadband services to cell phone users and wireless devices users with the plug-in mobile broadband cards. Another option is available to mobile offices or a group of computers on the move, from less than NZ$1000 installation fees. The SIU (Services Interface Unit acting as a modem) from Telecom and the 3G broadband router from Telecom will allow the mobile office to communicate wirelessly with the signal tower of the 3G Cellular networks, then connection is available for multiple-users.

In order to carry out a real-life mobile Broadband performance review of both networks, Computerworld (2006b, December) implemented a test, using Telecom's latest Sierra Wireless AirCard 595 and Vodafone's Merlin XU870 VMC Card. The following table provides the results from the test:

Table 3 – Telecom's EV-DO Rev A vs. Vodafone's HSDPA

(Original Source: Computerworld, 2006b)

Network	**Telecom's EV-DO Rev A**	**Vodafone's HSDPA**
Broadband Card	AirCard 595	Merlin XU870
Peak DL Speed	3.1Mbit/s	3.6Mbit/s
Peak UL Speed	1.8Mbit/s	384Kbit/s
Actual DL Speed	Just over 1Mbit/s	Just over 1Mbit/s
Actual UL Speed	200Kbit/s	150Kbit/s
Latency Time	50-70ms	130ms
Coverage	AKL CBD only	Auckland, Wellington Christchurch
Out Coverage	CDMA2000 1xEV-DO	UMTS-GPRS network

Computerworld (2006b) mentioned that EV-DO Rev A test results at Telecom's headquarters were 2.6Mbit/s down and 500Kbit/s up. In fact, the mobile broadband performance recorded in the real-life test do not reach this level and are poorer than the test results offered by the companies.

The mobile Internet plans offered by both companies have a very similar price, and so there is no price competition between Telecom and Vodafone's mobile broadband services, but competition on the quality of service. Nationwide, Telecom deploys Rev 'A' only in the Auckland CBD, 1xEV-DO in cities / towns and CDMA2000-1X in rural areas. The company aims to extend the Rev A networks to the major cities and towns and upgrade the CDMA2000-1X network in rural areas to 1xEV-DO by the end of 2007. On the other hand, Vodafone is running a bit faster than Telecom and its HSDPA technology is available in Auckland, Wellington and Christchurch, in addition the nationwide cellular network is operating on the WCDMA standard.

3G competition is always a war; operators should constantly and continually update their network and services. The Sunday Star Times (2005, August 15) mentioned Telecom New Zealand was not the solitary player in the 3G market when Vodafone started launching its 3G services in New Zealand and Vodafone's 3G is a headache for Telecom New Zealand. True, Vodafone International Group is the leading global GSM operator. While 3GSM becomes a 3G standard, Vodafone joins the New Zealand 3G market with an extensive range of technological and financial support. Vodafone's HSDPA network could offer 7.2Mbit/s download speed, however the company's initial deployment only offers 3.6Mbit/s. Vodafone will raise its download speed to 7.2Mbit/s and update its network to HSUPA (which mostly enhances the upload speed by a few megabits per second) around 2007 / 2008. Vodafone's updated network indeed offers better performances and services than Telecom's EV-DO Rev A network, but Telecom is running towards to its Rev B network, which is expected to be completed before 2009.

3.3.1.2 The Third 3G Network with W-CDMA

The role of Telstra Clear in the telecommunication industry is that of a large-scale operator. It has quite a big infrastructure especially in the Wellington and Christchurch areas and some built-in infrastructure in Auckland and the far north. Telstra Clear plans to launch the third 3G network in 2007 / 2008, this project is called 'Helix'. The network is a 2.1GHz UMTS WCDMA network, with the speed at either HSDPA or HSUPA (Computerworld, 2006c). In fact, the company has not decided which technology will be used when the deployment is completely implemented. The new network will be initially launched in the Tauranga region, and then the network will be expanded nationwide.

The three 3G network owners, Telecom, Vodafone and Telstra Clear, have to make a deal on roaming access between the 3G networks (Computerworld, 2005b). The deal is part of the Telecommunications Act 2001 and allows Telstra Clear regular access to the competitors' network; by the same token, its competitors, such as Telecom New Zealand can use Telstra's W-CDMA network.

Telstra Clear is a major operator in the fixed-line phone and broadband market. In addition, its fiber optics technology has the leading position in the New Zealand market. Due to the strong business background of Telstra Clear, it will become an effective distributor of deployment cell phone and mobile Internet services in New Zealand in the coming years.

3.3.1.3 TDD-UMTS Technology

Woosh wireless is cooperating with a leading wireless operator – IPWireless, which is based in the United Kingdom. Woosh offers wireless broadband services over the IPWireless's UMTS TD-CDMA 3G network in Auckland, Wellington, Christchurch and Southland. The network owner's website claims the TD-CDMA technology could supply wireless broadband at 9Mbit/s down and 3Mbit/s up; however Woosh Wireless deploys its wireless broadband services at only a 1.6Mbit/s download rate.

Woosh's deployment is very similar to both Telecom's and Vodafone's wireless broadband services (laptop users and mobile office), and their installation fees are comparably lower than Telecom and Vodafone's. It requires a Woosh PC Card for single users or a Woosh Wireless router for multiple-users. An antenna is used for enhancing the signal between the PC Card / Router and the base stations / cell sites. Woosh Wireless was facing a problem of limited coverage in the last few years, however the company expanded its coverage by purchasing an additional 180 UMTS-TDD stations from IPWireless (Wireless Forum, 2005a), and enhanced its competitive advantage in the wireless market.

As Woosh expands its network and coverage, the TD-CDMA network is coming up to the 3G cellular standard in supplying cell phone and mobile Internet services. The managing director of Woosh said: "It is possible we could turn the network into a mobile network." (Wireless Forum, 2005b) These moves are under planning and implementation at the moment. Woosh is will be able to join the mobile Internet market with Vodafone and Telecom, possibly with Telstra Clear. It is anticipated that Woosh could supply quality high-speed mobile services in the near future.

WiMax is innovative and attractive to service providers. Woosh spent a large amount of money on obtaining the WiMax spectrum license in the 2.3GHz band. The government's decision might possibly make a business loss for Woosh's WiMax plan, and the company is not making any further investment unless the WiMax spectrum is clarified (NZ Herald, 2007). Woosh will not give up building the WiMax nationwide wireless network for two reasons: Woosh has already spent a lot on WiMax and the technology could potentially enhance their business position in the fixed-line / mobile market in New Zealand.

3.3.2 WiFi (Hotspots) in New Zealand

Hotspots services, known as public LAN have become popular in recent years. The WiFi enabled mobile users, including cell phones, PDAs and laptops can connect to the IEEE 802.11-based local area networks - hotspots wirelessly in public areas, and then share broadband resources via ADSL or fiber technology (Ala-Laurila et al, 2001). Hotspots are welcome to mobile users because they offer comparably faster and more secure Internet services than services via the cellular networks. Normally, the connection speed is 54-108Mbit/s, which depends on the WiFi connection, either 802.11b or 802.11g. The main problem of hotspots is limited location, since the service is available within a particular area, for example, 100 square meters. However, WiFi hotspots could be deployed in customer-focused areas, such as the cities' CBDs.

In 2007, hundreds of hotspots have been deployed by several service providers in the CBDs of the main cities and some public locations such as airports, libraries, cafés and so on. Three major hotspots operators: Telecom New Zealand, City Link and iPass / T-Mobile own more than 90% of the hotspots market in New Zealand. According to the statistics provided by Jiwire, Telecom deploys 306 WiFi based hotspots via its DSL Network; City Link offer 96 hotspots over its Metropolitan Ethernet Optical Fiber LAN (Broadband Community, 2006); iPass / T-Mobile is the leading global hotspot service provider which has about 69,600 hotspots locations worldwide and 388 locations in New Zealand. (Jiwire, 2006)

FON Community brings a new concept to the deployment of WiFi services. FON members can share their local area networks by using FON's social router. The FON's social router works as a normal router, but it open sources the WiFi networks to other FON members while in use. When the FON users give up some bandwidth at home and share the WiFi network in the public, all FON hotspots worldwide become freely accessible to them. This is an innovative idea, which expands FON's WiFi network services, and the social router costs only UK£30 without any installation fees. FON successfully extended their service range and enlarged their global WiFi

network in the last few years. Customers can become part of FON's WiFi nation no matter whose Internet services they use. (Computerworld, 2007)

3.3.3 WiMax (IEEE 802.16) in New Zealand

WiMax is a technology which has the potential to provide support for high speed mobile data across a very wide coverage range and at a relatively low cost. In terms of speed, coverage and cost, WiMax is superior to other existing technologies and is able to deliver both mobile and fixed wireless Internet connectivity virtually replacing the two different types of wireless broadband technologies (fixed wireless and mobile wireless). Mobile WiMax will start competing with the current 3G mobile networks and the existing WiFi networks. Some service providers (for example, Woosh wireless) started to expand their Internet services with WiMax Technology. An ISP 'Call Plus / Slingshot' expects to build a nationwide WiMax network and it is currently having a WiMax trial in the Whangarei region. It will be very interesting to hear whether WiMax will be considered and used by the large network operators, such as Telecom and Vodafone.

3.4 Conclusion and Recommendations

In the area of mobile Internet deployment, 'anywhere' broadband service will surely be a reality in the future, possibly over a single-network and single technology, which will be the end of the convergence process. Again, in regard to the government's digital strategy, a competitive mobile Internet market will encourage a wide range of deployment models, increase the quality of service and answer all demands (both service providers' and the customers') in this field.

The convergence of the networks actually means the merger of networks and technologies, this is happening in New Zealand, and will be happening faster in the near future. Currently, multiple-networks and multiple-technologies means people can maintain services such as voice and fast Internet anywhere (private LAN, Home / Office LAN, public hotspots, WiMax network and the public cellular network).

Before people reach the final stage of convergence, network union is the “best connection” between different types of networks. Real convergence means the mobile network and the IP network will be merged and finally offer the same level of end-user service from the same platform, and that will be a single-network and a single-technology.

Networks consist of strengths and weaknesses in their deployment of services (for example, mobile Internet). It is more cost-effective and easier to provide technology that allows users to access different networks smoothly and enables continuous service. When multiple-networks are available in the same location, the technology and devices should allow users to choose the network and service which are best suited to them. Moreover, multiple-technologies are embedded in the mobile devices, such as Cellular Broadband, WiFi, WiMax, GPRS, and Blue-tooth.

In conclusion, the convergence of networks, technology and service is an ongoing development process. Mobile Internet is part of the merger solution and it should not be considered as a stand-alone service. However, mobile Internet deployment and development should be essentially integrated into the convergence plan. The researcher conducted a study of the mobile Internet deployments in New Zealand; the research processes and action descriptions of which will be described in the next few chapters.

Chapter 4: Methodology

Based on the environmental background and academic literature described above, a comparative study to investigate a mobile Internet deployment model and its impact on the New Zealand market was carried out, with the purpose of drawing a comprehensive picture of the market mix and identifying the factors influencing decisions about services offered to customers. The research project also identified and examined the emerging issues related to the deployment models used and investigated future plans and anticipated developments in the area. Technological trends, business models and end users are the three focuses of the study. Multi-case approach will be applied in conducting the research , and interviews will be used as the major technique for gathering research data.

4.1 Research Model and Research Questions

In order to obtain a research model which would be suitable for the investigation, the following process was used:

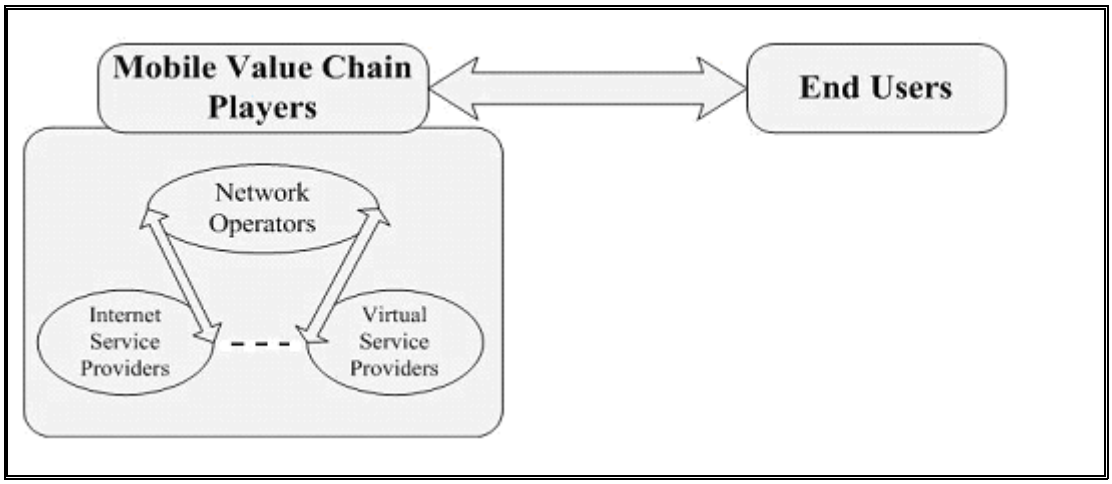
1) build an initial research model based on the literature in section 4.1.1;
2) revise and expand the initial model in section 4.1.2;
3) build the final version of the research model in 4.1.4 (with more extensive context and connections)
4) provide analysis of the three research questions in section 4.1.5.

The next few sections describe the process mentioned above.

4.1.1 Initial Research Model

The mobile Internet industry sector is mapped onto a research model adapted from the network value chain proposed in Soininen (2005), which also aligns with the mobile commerce reference model in Petrova (2005) (Figure 1) and section 1,1 – research motivation. The major reason for applying the value chain model mentioned in Soininen (2005) is that the model defines the scope and the targets of the study; it displays the link between service providers and customers. Also, Soininen (2005)

points out that the mobile Internet value chain is complex as each segment of the industry (for example,, networks) can be represented by its own multi-layered value chain. Adding to the complexity of the interactions, a number of actors in the value chains interact directly with customers (for example ISPs, but also network operators and content providers). Thus the value chain model proposed in Soininen (2005) is applied to the situation in New Zealand and it is assumed that the industry players (for example, network operators, Internet service providers and virtual service operators) interact with each other as well as directly with customers.



.**Figure 2: Initial Research Model (based on Soininen 2005 and Petrova 2005)**

The research aims to examine the interaction between the mobile value chain players and the end users. Mobile Internet deployment is a key factor as it is the medium between service providers and customers. Although the initial research model introduces the main factors of the research project, it is too general and lacking in detail to demonstrate how mobile Internet would link to those factors. Therefore, an expanded research model was required and constructed later.

4.1.2 Expanded Research Model

The initial research model is lacking in descriptive information, therefore the researcher went a further stage to expand the research model, in order to draw a more comprehensive picture of the study as mobile Internet deployment was not involved in

the original research model. Based on the research objectives (section 1.2) of the study, and aligned with the customer relationships in mobile gaming proposed in Petrova & Qu (2006), the expanded research model (Figure 3) was built and some new considerations were introduced as follows:

Competition and the market: *As all industry players are looking to expand their business models, the mobile industry segment is extremely competitive.*

Service providers: *Virtual service operators as identified in Soininen, (2005) have not yet entered the active market in New Zealand but may do so in the future.*

Mobile Internet Deployment: *acts as a middle factor that links the services providers and the end users. This research project focuses on deployment models but also investigates its impact on the market and the customers.*

Convergence: *based on the literature, there is a connection between the 'mobile Internet deployment' and convergence of networks, technology and services, therefore 'convergence' should be involved as a factor.*

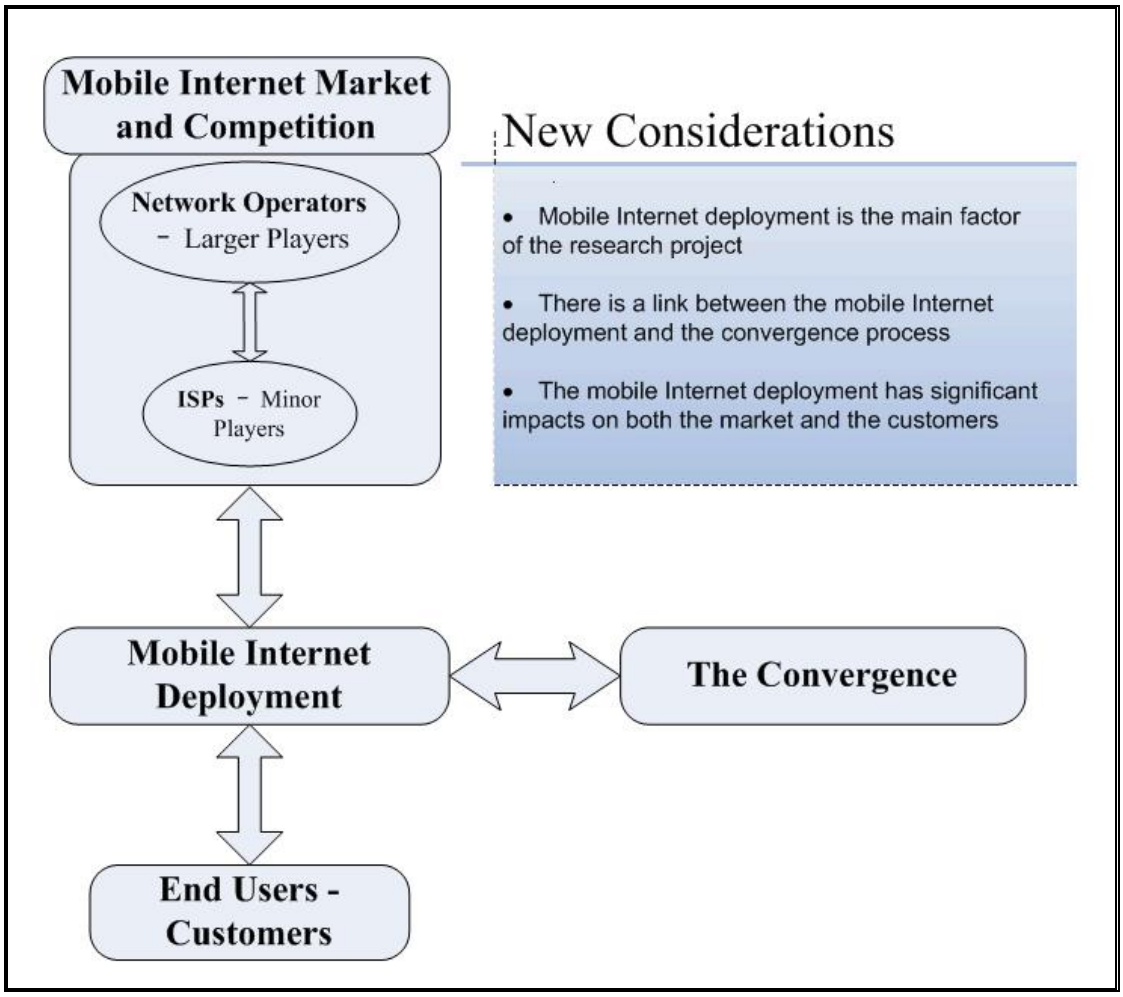


Figure 3: Revised Research Model

The expanded research model (Figure 3) clearly demonstrates the research factors that are involved into the study. However, it does not have enough information to build the research questions. As a result, based on the expanded research model, the researcher also went back to look at the main mobile Internet research areas and research themes (Table 1 in Chapter 2), in order to define the study's research questions.

4.1.3 Research Context

Referring to Table 1 in the literature review (Chapter 2) and the expanded research model (Figure 3), the researcher built Table 4 – Mobile Internet Deployment Research Context, which describes the main research focus and some sub-questions investigated at lower levels. The researcher intended to find the answers of the

sub-questions in order to construct knowledge on which to build the research questions.

Table 4: Mobile Internet Deployment Research Context

Research Focus		Sub-Questions
Customer – use, adoption, services	● Consumer behavior of intention to use mobile Internet ● End-user requirements of mobile Internet services ● Benefits to the users	➢ How will mobile Internet benefit end users? ➢ What are the user requirements for mobile Internet deployment? ➢ How will consumers choose new service such as mobile Internet?
Deployment models	● Critical success factors for implementation ● The requirements of deployment. ● Value chain models. ● The impact of the convergence process ● The impacts on business models.	➢ How will the deployment model fit into the market? ➢ How will the deployment model meet the customer's expectations? ➢ How will mobile Internet contribute to the convergence process and affect the business environment?
Networks and technology	● Convergence of networks and technology, and the impact on services ● Mobility against fixed-line, and support at all layers of the protocol stack ● Quality of service, strengths and weaknesses of the technologies. ● Global mobility and interoperability. ● Future trends, next generation networks and technologies.	➢ What do future network, technology and services look like? ➢ How will the convergence process impact on the future end services? ➢ What issues (network and technology) in New Zealand are different from other countries?

In summary, the research context built in Table 4 was not the final research questions. They were defined because the researcher was interested in finding the answers to them through the research project. From there they were merged and applied to the final research model.

4.1.4 Final Research Model and Research Questions

The direction of the study is aligned with the work on deployment and management models in Table 4 – the middle layer. The three research questions are essentially related to 'Mobile Internet Deployment', which is the defining context of the study. The study also investigates how mobile Internet would influence end users (for example, customers' behavior and expectations) and the market (for example, value chain players and the business environment) – ***Research Question 1,*** this is the most important research question in the study, because the outcomes of this question will present the requirements and considerations of the model Internet deployment models in New Zealand; also will contribute to evaluate the most suitable deployment model in the country, which is considered as the implication of the research project.

Apart from that, the research project in addition investigates how mobile Internet will contribute to the convergence process, through the convergence of networks and technologies (for example, the process of the convergence, the strengths and weaknesses of the current technologies) - ***Research Question 2 and Table 4 – the bottom layer.***

Furthermore, the reseerch project examines how will mobile Interent bring bring services of value to customers as highlighted in the literature on mobile Internet services adoption (for example, the services on the converged networks and the converged technologies) - ***Research Question 3 and Table 4 – the top layer.***

Based on the description above, the final research model of the project was constructed (Figure 4) and three research questions concerned with 'mobile Internet deployment' were formulated as follows:

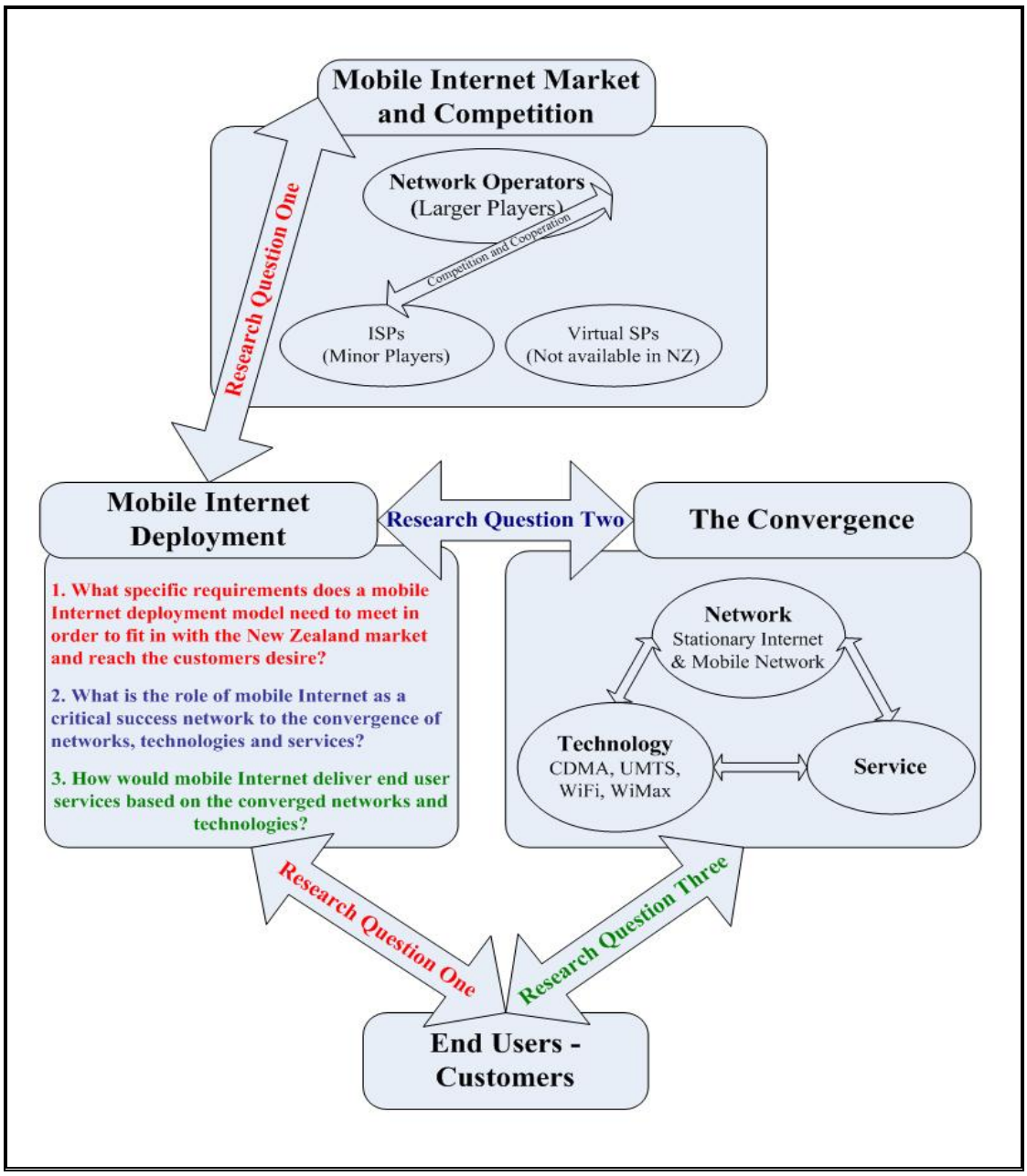


Figure 4: Final Research Model

Research Question One: *What specific requirements does a mobile Internet deployment model need to meet in order to fit into the New Zealand market and answer customers' requirements?*

The telecommunication and Internet market is competitive; customers' requirements have shifted slightly from fixed-Internet to mobile Internet. This research question intends to find out how the services providers would deploy mobile Internet services from two perspectives: the market and customers.

Research Question Two: *What is the role of mobile Internet as a critical success factor to the convergence of networks, technologies and services?*

Mobile Internet, as an innovative service, can be deployed from both mobile Internet and stationary Internet. This research question intends to find out whether mobile Internet will contribute to the convergence of networks, and also investigates whether the convergence of technology and service is in line with the convergence of networks.

Research Question Three: *How would mobile Internet deliver end user services using converged networks and technology?*

Although a trend for convergence can be observed currently, the convergence of networks and technologies is not complete. This research question also intends to investigate the connection between mobile Internet deployment and future network and technology, convergence. The researcher applies an opposite angle to research Question two and examines how convergence will impact on service deployment (for example, mobile Internet).

In summary, the statements above describe the intention of the research question. In-dept analysis of the research questions are provided next.

4.1.5 Research Questions Analysis

Based on section 4.1.3 (Research Context) and the Final Research model (Figure 4), the researcher broke the research questions into smaller sub-questions, in order to better construct the interview questions in section 4.2.3.

Research Question One: *What specific requirements does a mobile Internet deployment model need to meet in order to fit into the New Zealand market and answer customers' requirements?*

The researcher aims to find the answers to the following four sub-questions, in order to obtain the answer to research question one:

- What does the telecommunication and Internet market look like?
- Does the competition have a shift from fixed-line to wireless / mobile?
- Does mobile Internet deployment influence the market, competition, and business model?
- How does mobile Internet deployment model attract customers and how do the consumers choose to use mobile Internet services?

Research Question Two: *What is the role of mobile Internet as a critical success factor to the convergence of networks, technologies and services?*

The researcher aims to find the answers of the following four sub-questions, in order to obtain answers to research Question two:

- Will mobile Internet contribute to the convergence of networks, technologies and services and how the convergence is achieved?
- What are the strengths and weaknesses of each technology that is currently available to deploy mobile Internet services?
- What is the most suitable technology currently available for the deployment mobile Internet services
- What are the future trends in networks and technology

Research Question Three: *How would mobile Internet deliver end user services using converged networks and technology?*

The researcher aims to find the answers of the following three sub-questions, in order to obtain answers to research question three:

- How will the process of convergence look like?
- How will the convergence (network and technology) have impacts on the services deployment (for example, mobile Internet)?
- What kinds of end user services are available on converged networks and technologies?

In summary, research question analysis allows the researcher to have a better understanding of the research questions. This analysis also divides the three research questions into some lower level sub-questions. These sub-questions are helpful in building the interview questions for the research design section (section 4.2.3).

4.1.6 Summary

The initial research model contained general mobile Internet research factors proposed in the literature. The researcher took a further step to build an expanded research model. Two new research factors (the convergence process and mobile Internet deployment) are added to the initial research model. The researcher also formulated the research focuses based on the research themes (Table 1). This process clarified the research directions and the objectives.

Three research questions and the final research models were built and therefore, the researcher knew what kind of information should be obtained from the research project. The next section is research design, the researcher needed to find a way of collecting and analyzing data in order to achieve the research goal and gather accurate information to answer the research questions.

4.2 Research Design

Following on from the research model and research questions formulated in the previous section, the researcher examined the mobile Internet deployment in a particular geographical area – New Zealand. This section describes the research methods and methodologies that the researcher adopts in the study, also the risk factors, research rigor and case setting are explained.

4.2.1 Types of Research

Collis and Hussey (2003) introduce four parts of the research process: research purpose, research process, and research logic and research outcome. The researcher applies the classification concept from Collis & Hussey (2003, p.10), in order to clarify the type of research conduced in the research project.

4.2.1.1 Purpose of the Research

The research project intends to find answers to three research questions formulated in the previous section. According to the context and the purpose of the research questions, the conducted research can be classified as both *descriptive research* and *analytical-explanatory* research.

Research question one asks “what are the requirements?” and research question two asks “What is the role?” The answers to these two questions are likely to be a *description* of an *existing phenomenon*. The researcher tries to find the answers to the defined problems from “obtained information”. As a consequence, the conducted research project is descriptive research.

Moreover, Collis & Hussey (2003, p.11) mention that: *“analytical or explanatory research is a continuation of descriptive research.”* The researcher also prepared the third research questions, which asks “How will mobile Internet provide end-user services?” To answer this particular research question, the respondents should not only understand the phenomena, but also need to realize the causal relations between

phenomena.Therefore, the conducted research combines the *descriptive* method and the *analytical-explanatory* method, but it tends to be more on the descriptive side.

4.2.1.2 Research Process

The researcher applied a *qualitative approach* in conducting this research project. In order to find the answers to the research questions, the researcher had to gather information from different sources (for instance,. literature or participants). In the actual research process (See Figure 5), literature only stated the research areas and helped to construct the research problems, the information provided by the participants is the main research data running through the research process.

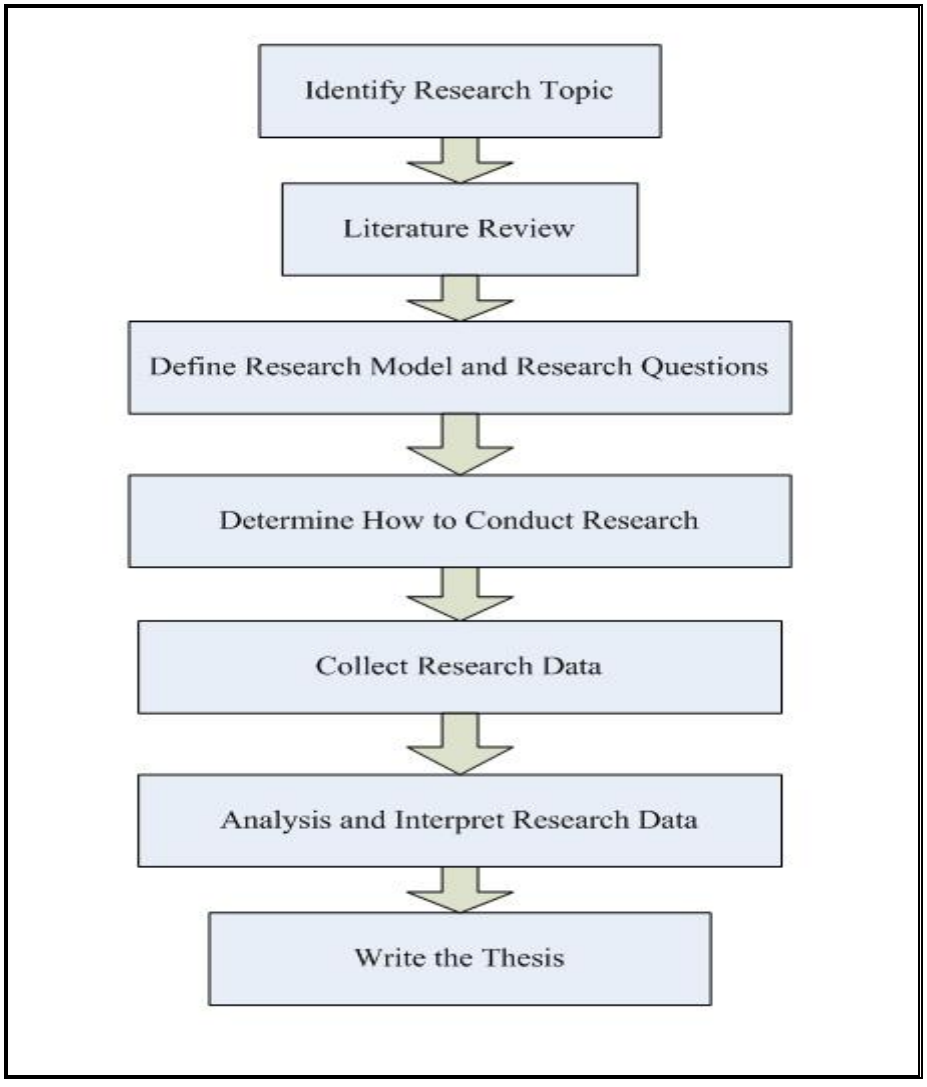


Figure 5: Research Process

Cavana, Delahaye and Sekaran (2001, p.34) point out that: "*The aim of qualitative research is to discover how humans construct meaning in their contextual setting*". The participants' thoughts become the major data contributing to the research outcome. However, the participants have to reflect on their perceptions and understanding of the research area, in order to examine social and human factors.

4.2.1.3 Research Logic

When looking at the logic of the research, the conducted study is *inductive* research. The research model and research questions are constructed based on knowledge of the literature and the observation of practical reality.

Sekaran (2000, p.26) describes this *"Induction is a process where we observe certain phenomena and on this basis arrive at conclusion"*; Cavana, Delahaye and Sekaran (2001, p.36) also mention four steps in inductive research:

1) Observe phenomena;
2) Analyze themes;
3) Formulate Relationships;
4) Build Problems.

This research follows this process; Chapter 3 – research background describes the observation on the mobile Internet environment in New Zealand; Chapter 2 works on the research areas and themes; Chapter 4 builds the research model (identifies the relationships) and constructs the research questions. As can be seen, this research project is an inductive research

4.2.1.4 Research Outcomes

Sekaran (2000) points out that, *"Research done with the intention of applying the results of the findings to solve specific problems currently being experienced in the organization is called applied research."*

This research study contains three research questions, and the research questions are built based on the literature and observation of the market. The research outcomes are the answers to the research questions carried out in Chapter 5 – Case Review and Chapter 6 – Case findings. The researcher intends to apply the results to solve problems in the area of mobile Internet deployment in New Zealand (for example, its requirements).

Therefore, the conducted research is applied research.

4.2.1.5 Summary

In summary, this thesis is applied, descriptive research using a qualitative and inductive approach. Section 4.2.1 describes how the conducted research project fits into the 'types of research classification model' introduced in Collis & Hussey (2003). The next section focuses on the multi-case study approach and the researcher explains why this approach is suited to this research project.

4.2.2 Research Strategy – Multi-Case Study

Case study is used as a research strategy in this research project. Yin (1994, p.13) states the case study is an empirical inquiry that: *"investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident."*

The researcher uses interview to collect qualitative data in order to answer the research questions previously formulated. Each individual interview is considered as a single case study, thus the information collected from several interviews means that this research project is based on a multi-case study approach.

A multi-case study approach is adopted to investigate the research questions., the 'case study research approach' is identified as a qualitative method (Simeon, 2004,

p.151). Since a multi-case study combines different opinions and views (Herbert, 2005, p.41) by participants, the researchers can apply this research approach to carry out the examination of contrasting situations in the New Zealand mobile Internet environment.

The biggest advantage of applying a multi-case approach is that the research can gather a broader range of information from participants and then summarize the data into more focused points of view and answer the research questions. In the research process, participants are asked similar interview questions (section 4.2.3.2) that are essentially related to the research questions, thus a number of opinions (either agreement or disagreement) can be evaluated (Chapter 5 & 6) and analyzed (Chapter 7). The researcher does not evaluate whether the multi-case data is right or wrong, but examines the reasons why the participants show agreement or disagreement to the research questions.

Using a multi-case approach, the researcher can apply in-depth analysis and data evaluation process finding interactions between participants and their specific context (Tress, 2006, p.179). Research outcomes and conclusions can draw in a wider social validity compared with a single case study (Carley & Lawler, 1996, p.163).

In summary, this research is not only finding the answers to the research questions, but is also looking at what businesses and professionals think about ‘mobile Internet deployment’ and its impact; therefore, a multi-case study approach is the most suitable research method to conduct this study. Section 4.2.3 introduces the research method. Interview is adopted as the main research technique in data collection and the research project is focused on a multi-case study approach.

4.2.3 Research Technique: Managing Interviews and Interview Data

In order to gain an understanding of the market and the business environment in the country, the researcher adopted interview as the major technique to collect the research data and applied a multi-case study approach to conduct the research.

4.2.3.1 Interview Description

The researcher use interview as the research technique to collect the research data and invited participants to take part in the research project. The interviewees were chosen from organizations that deploy mobile Internet services in the telecommunication and Internet market. The outcomes (gathered qualitative data) from the interviews have two perspectives: *business focus* and *personal insights*.

The researcher tried to find the answers the research questions from the interviews, so it was very important to reach appropriate participants and ask them suitable interview questions (section 4.2.4).

Apart from interviews, the researcher also conducted preliminary research and collected general business information from New Zealand journals, magazines and business websites, in order to be more familiar with the chosen organizations and prepare for the interviews that were specific to the chosen interviewees.

Table 5 describes some considerations the researcher used to design the format of the interviews, (for example, number of interviews, time duration of the interviews and so on). The invitation letter, the participant information sheet, the consent form, and the confidentiality form are attached in the Appendix.

Table 5: Interview Format and Description

Interview Format	Description
Numbers of Interviews	4-8
Interview Location	Auckland
Duration of Each Interview	30-45 minutes
Invitation Letter	Required (Post or Email)
Confirmation Letter (Consent form)	Required (Post)
Interview Type	Structured Interview
Interview Questions	Required
Anonymity	Name of the company and interviewee
Confidentiality	Required

In summary, the advantages of adopting the interview as the main technique in the study are:

1) Smaller number of participants;
2) The interviewees understand the research topic and questions;
3) The interviewees provide qualitative data;
4) Time requirement is low.
5) The cost of the research is low.

The next section explains how the interview questions were designed and built.

4.2.3.2 Interview Question Design

The previous section 4.2.3.1 explains the reasons for using interview as the main technique for data collection. The researcher tried to obtain answers to the research questions from collected interview data. However, the researcher could not ask the research questions directly to the participants, because the participants may not entirely understand the research questions. The three research questions were formulated from the research focuses and ideas presented in Table 4 (Mobile Internet

Deployment Research Context), and the research questions cover a broad range and several sub-questions. If the research questions are asked directly to the participants, the answers to the questions may not cover all the aspects that the researcher requires, and also the answers may be less accurate.

In order to gather high quality and accurate information from the participants, the researcher has constructed 10 research interview questions, which are essentially related to the research questions and research question analysis (section 4.1.5). This section describes the interview questions and explains how they are constructed.

Table 6 shows how the 9 main interview questions are linked to the three research questions applying this connection the researcher can find the answers to the research questions from the interviews more easily. Although the process may not exactly be as expected, it is still the best way to avoid getting inaccurate information and ensure the quality of the interview data. Further explanation of the interview questions will be presented as follows.

Table 6: Interview Questions and Research Questions

Research Questions	Interview Questions
Research Question One: *What specific requirements does a mobile Internet deployment model need to meet in order to fit into the New Zealand market and answer the customers' requirements?*	**1, 2, 3, 4, 5,**
Research Question Two: Research Question Two: *What is the role of mobile Internet as a critical success factor to the convergence of networks, technologies and services?*	**6, 7, 8, 9,**
Research Question Three: *How would mobile Internet deliver end user services using the converged networks and technology?*	**3,4, 7, 8,**

1. **Could you please explain the role of your company in the telecommunication and Internet market?**

Although this question is not directly related to the research questions, it is considered an opening for the interview.

2. **Could you please briefly describe the telecommunication and Internet market mix in New Zealand?**

The question is linked to research question 1, because it aims to investigate the market in New Zealand. The answers to this question will provide an environmental background for mobile Internet deployment. The perspectives of the respondents add to the understanding gained from the literature.

3. **Do you think that Internet competition has moved from fixed-lined Internet to mobile / wireless Internet? Could you further explain your answer**

The shift from fixed-line to wireless network services might result in an increase in the popularity of mobile Internet. The researcher aims to find issues related to the wireless sector such as the impact on the environmental background and mobile /wireless adoption for example, consumer behavior from this interview question. Therefore, this question is linked to both research Questions 1 and 3.

4. **Does your company offer or plan to offer mobile Internet services? If the answer is yes, could you please briefly describe the service and its deployment?**

The chosen organizations are offering and planning to offer mobile Internet services. The researcher aims to find out how the service providers will deploy mobile Internet services, and what they will consider when deploying the services. This question is

linked to research question 1. In addition, to this mobile Internet is an end user service from the perspectives of convergence, thus this question is also linked to research question 3.

5. **In your opinion, what specific requirements does a mobile Internet deployment model need to meet in order to fit into the New Zealand market and meet customer expectation?**

Questions 1-4 gives a general introduction to the participants, makes them more familiar with the research area and the research intention. Following on from Questions 1-4, this is a question directly linked to research question 1.

6. **Several technologies (for example, mobile networks, WiFi and WiMax) are available to deploy mobile Internet services presently; could you please give me some personal ideas about the strengths and weaknesses of each deployment model?**

The convergence of networks is still in process, presently multiple-technologies may run on a single network. This question aims to identify the strengths and weaknesses of the current technologies supporting mobile Internet services. These opinions may be provided based on a prediction of the future. Thus, this question is essentially linked to research Question 2.

7. **Do you think mobile Internet will contribute to the convergence of networks, technologies and services? How?**

Building on question 6, this is a question directly linked to research question 2. The researcher would be able to gather additional information about the current technologies, and try to work out how mobile Internet would be a driver to convergence. In addition, this question offers an initial point that links the end user

services to the convergence of networks and technologies; therefore, it also has a connection to research Question 3.

8. **Could you please describe how mobile Internet will deliver end user services based on converged networks and technologies? (for example, cross network, multiple-technologies)**

This is a direct question to research Question 3, focused on end user services; it also aims to identify the impact of convergence on mobile Internet. The researcher asks the research question directly because it is an analytical question for the respondents (see section 4.2.1.1) and the researcher wants to find out how the respondents understand the research question itself.

Furthermore, this interview question has a connection to research Question 2. As defined in section 4.1.4 (Research Model and Research Questions), research Question 3 applies an opposite view to research Question 2, and investigates the convergence process in terms of networks, technologies and services.

9. **What would be the most appropriate mobile Internet deployment model or solution for the New Zealand market based on your personal ideas and experiences?**

This question is linked to one of the main objectives of the research project. The researcher intends to provide recommendations about 'the most suitable mobile Internet deployment model for New Zealand.' The participants answer this question based on the current situation and on their views of its development within the next 10 years.

10. **Do you have additional information about this topic? 'Mobile Internet deployment in New Zealand'**

This question aims to find out if the participants have some additional information that the previous nine questions do not cover.

In summary, ten interview questions were constructed and were asked during the interviews. Since the interview questions were formulated based on the understanding of the research questions, the answers are expected to be useful in answering the research questions. The next three sections are 'Data Collection Method', 'Data Review Method' and 'Data Analysis Method'.

4.2.3.3 Data Collection Method

The researcher explored the New Zealand mobile Internet and telecommunications environment. The preliminary (secondary) data was gathered from multiple sources (for example, business websites, newspapers, magazines and journals). When the research model and research questions were formulated, and the interview had been chosen as the main technique for collecting information, a data collection instrument and a process to be followed throughout the research project were designed.

The benefits of using 'interview' to collect case study data are described in Yin (2003, p.80); as 'targeted' and 'insightful'.

Targeted - has a focus on the case study topic directly: mobile Internet deployment in New Zealand. The interview questions are designed based on the research questions and are focused on the research area, therefore, the collected information are specifically targeted to the research topic.

Insightful – provides perceived causal inferences: the interview data contains business focus and personal insights. The participants understand the research topic

and questions; they are professionals in mobile Internet deployment, therefore, their perceived inferences are supportive in answering the research questions.

The major network operators and Internet service providers in New Zealand offering mobile / wireless broadband were chosen as participants in the study. An invitation letter and a consent form were sent to the selected participants. The participants accept the invitation by signing the consent form, and then the researcher would conduct interviews with the participants at a face-to-face meeting. The participants would be asked several questions during the interview and a digital recorder would be used to record the interview. The researcher would transcribe the interview into text, the names of the organizations and the participants would not be mentioned in the study. The transcribed text would be used in the following Chapters: Chapter 5 *Case Review* and Chapter 6 *Findings*.

In summary, apart from the main data gathered from the interviews, the researcher also collected additional information from different type of resources, for instance, academic literature, journals, magazines, newspapers and business websites, in order to support the '*Analysis and Discussion*' chapter.

4.2.3.4 Data Review Method

The transcribed interview data are considered primary and raw data; they are used in presenting and summarizing the main opinions of the participants' in two ways: vertical and horizontal.

The vertical approach is presented in Chapter 5 – *Case Review*, the researcher represents the main opinions from the conducted interviews. The review process follows the presentation of the interviews and the researcher will present all the answers of the different cases to the interview questions.

The horizontal approach is presented in Chapter 6 – *Case Findings*, based on the case review, the researcher lists and explains the main opinions of the reviews, also formulates the research findings that include all the participants' agreements and ideas.

In summary, the 'horizontal' approach allows the researcher to observe the data range and the considerations covered, while the 'vertical' approach allows the researcher comparative analysis later on; therefore both review processes would finally contribute to the analysis and discussion.

4.2.3.5 Data Analysis Method

The information gathered from the interviews are reviewed and evaluated in the review and findings processes. There are two main objectives in the data analysis section:

1) To answer the research questions;
2) To discuss the implications of the study.

The main data are collected from the participants (Interviews), and the participants are representing their businesses. The chosen organizations are part of the mobile Internet market, and they are competing with each other; thus they may present differing view points or offer different answers to the interview questions. According to the research model (Figure 4), there are two business models (network operators and Internet service providers) involved in the study, it is very interesting to find out whether different business models have dissimilar opinions in this particular area. Therefore, the comparable analysis is applied in a cross-case manner.

Collis and Hussey (2003, p.252) point out two challenges of qualitative data analysis: reducing the data and structuring the data. These challenges build basic contributions which allow the researcher to easily find the answer to the research questions and make a commutative discussion in the multi-case approach.

In the actual process of the research study, these challenges can be presented as follows:

Reducing the data – the data gathered from the interviews are summarized in Chapter 5 – Case Review; then the researcher picks the main points in particular areas as Case Findings – Chapter 6; the final step is finding the answers to the research questions from the review and the findings.

Structuring the data – the researcher formulated interview questions based on the research questions and conducted structured interviews with the participants. Therefore, the data collected follows the structure of the interviews. The review and findings process structures the data into 'horizontal' and 'vertical' approaches (section 4.2.3.4).

4.2.3.6 Summary

The research project is an applied-descriptive-qualitative-inductive research; it adopts a multi-case study approach and uses interview to collect qualitative data from the respondents. The participants are chosen because of their proficiency and expertise. The participants understand the research topic and they can offer personal insights and business focuses. The next few sections describe the research paradigm, research rigor and risk factors.

4.2.4 Research Paradigm

This section justifies the research paradigm

Collis and Hussey (2003, p.54) explain that *Phenomenological* research is normally conducted from a qualitative approach. According to Collis & Hussey, (2003, p.55), Table 7 describes the evidence that shows how the research meets the requirements of the phenomenological (qualitative) research paradigms:

Table 7: Features of Phenomenological (Qualitative) Research Paradigm (Collis & Hussey, 2003, p.55)

Features	Evidences
Tends to produce qualitative data	The participants provide qualitative data from the interviews
Uses small samples	There are 5-8 participants involved in the research project.
Data is rich and subjective	The participants can provide any information related to the research area and interview questions.
Concerned with generating problems	***The conducted research does not meet this requirement***

The content in Table 7 is used for the justification process later on. Although the research conducted meets some requirements of the phenomenological paradigm, for instance, from the ontological point of view, the research conducted meets the requirement because participants are involved; on the other hand, from the epistemological point of view, the conducted research meets the requirement because the researcher interacts with the researched context. In fact, a core problem in Table 7 (concerned with generating problems) is not met.

However, although the conducted research project meets most requirements of the phenomenological research paradigm; the researcher believes that the research paradigm is more likely to be post-positivist. Some evidence found in Crossan (2003) and Guba (1990, p.29) that a post-positivist research paradigm is applied to the study is as follows:

1) The research goal is mentally constructed by the individuals – the participants are asked to contribute to the investigation of the research goal.

2) The researcher uses flexible and multiple methods
    a) Flexible – structured interviews and well designed questions
    b) Multiple data collection methods – literature review, observation of the market and interviews.
    c) Multiple data review methods – vertical review and horizontal review processes
3) The researcher interacts with the research data and findings

To sum up, since the research conducted does not meet all requirements of the phenomenological research paradigm, more evidence shows that a post-positivist paradigm is applied to this research project.

4.2.5 Research Rigor

This section describes the research rigor of the study. Table 8 provides evidences as to how the researcher conducted a good research project and met the rigor requirements (for example, *Credibility, Worthiness, Reliability, Neutrality* and *Conformability*):

"A good theoretical base and a sound methodological design would add rigor to a purposive study; Rigor connotes carefulness, scrupulousness and a degree of exactitude in research investigation" (Cavana, Delahaye & Sekaran, 2001, p.29).

Table 8: Rigor Requirements and Characteristics of a good research project

(Cavana, Delahaye & Sekaran, 2001, p.29)

Requirements	Characteristics	Evidences
Credibility	Good Literature Review	The literature review (Chapter 2) states the research areas and provides the fundamental background of the study.
Credibility	Sound Preliminary Research	The research background (Chapter 3) allows the researcher to understand the

		mobile Internet market and its environment in New Zealand.
Credibility	Meaningful Conceptual Model	The research model is built based on the understanding of the literature and the environment; it demonstrates not only the research factors but also the connections between those factors. (Chapter 4)
Worthiness	Valuable Research Question	The understanding and the analysis of the research questions explain the purpose of the research; the answers to the research questions cannot be found in the previous literature. (Chapter 4)
Reliability	Logical Structure	The structure of the conducted study follows a logical pattern.
Reliability	Analytical Methodology	The researcher applies the most suitable research methodology 'Multi-case study' with research technique - interviews to conduct the research project (Chapter 4).
Neutrality	Comparative Analysis	The researcher does not agree or disagree with the statements offered by the participants; additional literature is used to evaluate the accuracy of the research findings.
Conformability	Integration between methodology, literature, analysis and conclusion.	The context of the study is firmly linked between all chapters and the sections,

In summary, the researcher made a lot of effort on Chapter 2: Literature Review – classifies the research areas and find out the relevant resources in to the areas; Chapter 3: research background – investigating the market and the co-relationship between the

mobile Internet value chain players; Chapter 4: methodology – designing the research model, questions, method and process. The content of the research is logical and easy to follow, which is also a key factor in maintaining the rigor of the research study.

4.2.6 Risk Factors

Following on from research rigor described above, this section describes the risks that are relevant to this study. While the risk factors would not directly lead to the failure of the study, they may influence the validity and reliability of the research, thus the researcher should carefully consider the risk factors, carry out the impact analysis of the risks and provides a solution to avoid those risks

Factor 1: Cannot obtain accurate information to answer the research questions.

'Accurate' here means the gathered information should be correct and clearly answer the research questions. The researcher should build the interview questions based on an understanding of the research questions and ensure 'structured interviews' are conducted with the participants. If the researcher cannot obtain enough accurate information from the first interview, additional interviews (face-to-face or email) are required in order to maintain the quality and quantity of the research data. Having accurate research data has significant impact on the reliability and the validity of the research outcome.

Factor 2: Not having suitable participants involved in the study.

'Suitable' here means a company or an organization represented in the industry. The research model shows that both network operators and Internet service providers will be investigated, thus the participants should be chosen from at least one network operator and or one Internet service provider. The best people to be participants in the research are CIOs of the organizations, because people in this role are more familiar with the current market, future trends, and knowledge of this area. If the CIOs are not available, the researcher should look for a participant who at least knows mobile

Internet and the New Zealand market and is at a relatively senior position within the company.

Factor 3: The participants do not understand the interview questions.

It is important to make sure that the participants understand the interview questions and provide accurate information. If the interviewees do not fully understand the questions, the answers to the question may not be helpful to the study. To mitigate the risk, the researcher should explain the interview questions or break them down into sub-questions, if the interviewee's response shows some misunderstanding. The researcher can conduct the interview through a 'free talk' technique rather than using a more rigid method such as "ask and answer".

In summary, the risks factors can be avoided or mitigated if the researcher follows the requirements of research rigor; the risk factors should be carefully considered because they may significantly influence the research outcome and validity. The risk factors have to be realized in the early stage of the research project, and the risk solutions should be built in to minimize negative impact.

4.2.7 Case Setting

The researcher conducted five face-to-face interviews in March 2007, with participants from the leading telecommunication companies in Auckland. Each interview took 30-60 minutes and five organizations (two network operators and three Internet service providers) were chosen as participants to the research project. This section presents a description of the conducted interviews; however the name of the companies and interviewees cannot be stated because that information is considered private.

4.2.7.1 Case Requirements

Before the researcher started the interviews, several requirements were formulated and applied to both the 'individual case' and the 'multi-cases'. Meeting all the

requirements of the case studies can minimize the possibilities of risk (section 4.2.6). Table 9 lists the general requirements of the case studies:

Table 9: Requirements of the Individual Case and the Multi Case

Requirements of Individual Case	Requirements of 'Multi-Case'
R1: The organization is a New Zealand company. **R2:** The organization deploys or plans to deploy mobile Internet services. **R3**: The participant accepts the invitation and feels interested in the research project **R4:** The interviewee is senior management staff. **R5:** The interviewee answers all the questions **R6:** The interviewee understands the research area and provides suitable answers. **R7:** Extra interviews or meetings if the researcher wants to obtain more information	**R8:** The participants should include at least one network operator and one Internet service provider. **R9:** The chosen organizations adopt different technologies and deployment models **R10:** The chosen organizations are playing different roles in the mobile Internet market. **R11**: The participants provide different views to the interview questions. **R12:** All the answers of the participants should be able to answer the research questions and form a comparative analysis.

In summary, there are five individual cases (interviews) in the research project; the next section describes which requirements were met and why some requirements were not met in the actual situation.

4.2.7.2 Actual Process

In the actual process based on the requirements defined above (section 4.2.7.1), two major network operators and three Internet service providers participated in the study. The chosen organizations have different business backgrounds, technologies and customer focuses, they have been selected because they deploy or intend to deploy mobile Internet services. Furthermore, the participants may provide different opinions

on mobile Internet deployment in New Zealand, both agreement and disagreement is provided in the interview data.

In accordance with the risk factors defined in section 4.2.6, the researcher intended to invite the senior management staff (for example, CIOs) to participate in the research, and indeed the researcher reached the management level (for example, General Manager Information Systems, Wireless Solution Manager, Marketing Manager Wireless Office and so on) and obtained high quality data from the interviews. As a consequence, the 'Risk Factor 2' was avoided.

Sometimes, in order to help the participants understand the interview questions and avoid 'Risk Factor 3', the researcher asked the interviewees some additional sub-questions (Except Case 3) and always kept the interviews on track.

Moreover, when unclear statements were found in the interview notes or additional questions were created, the researcher liked to conduct a second interview with the participants, either face-to-face meeting (for example, Case 2 and Case 3) or email (for example, Case 1).

Table 9 in the previous section lists all the requirements of the case studies, and Table 10 below describes the status of individual case and multi-case requirements in the actual research process: Note: "√" means the requirement is met.

Table 10: Actual Research Process vs. Requirements

	R1	R2	R3	R4	R5	R6	R7
Individual Case 1	√	√	√	√	√	√	√
Individual Case 2	√	√	√		√	√	√
Individual Case 3	√	√	√		√	√	√
Individual Case 4	√	√	√	√	√	√	
Individual Case 5	√	√	√	√	√	√	
	R8	**R9**	**R10**	**R11**	**R12**		
Multi Cases	√	√	√	√	√		

In summary, more than 95% of the individual case requirements were met and 100% of the multi-case requirements were met in the actual research process. Therefore, the research project successfully reaches the requirements of the case studies and the risk factors may have a low likelihood of occurrence.

4.2.8 Summary

The research design section 4.2 covers a description and explanation of: *Types of research* – descriptive, inductive, qualitative and applied; the *Research Strategy* – multi-case study strategy; the *Research Technique* - managing Interviews and interview data; the *Research Paradigms* - phenomenological-qualitative research paradigms; *Research Rigor* – reliability, worthiness, neutrality, credibility and conformability; the *Risk Factors* and the *Case Setting*.

4.3 Conclusion and Recommendations

Chapter 4 describes the research process, research logic, research factors and outcomes. Although the interviews were conducted individually, the researcher applied a multi-case approach to review the collected data. In the next few chapters the connection between single cases will be stated in the ‘Chapter 5 – Case Review’ and ‘Chapter 6 Case Findings’; a qualitative analysis will be used to answer the research questions and conduct a comparative discussion in Chapter 7, see Figure 6.

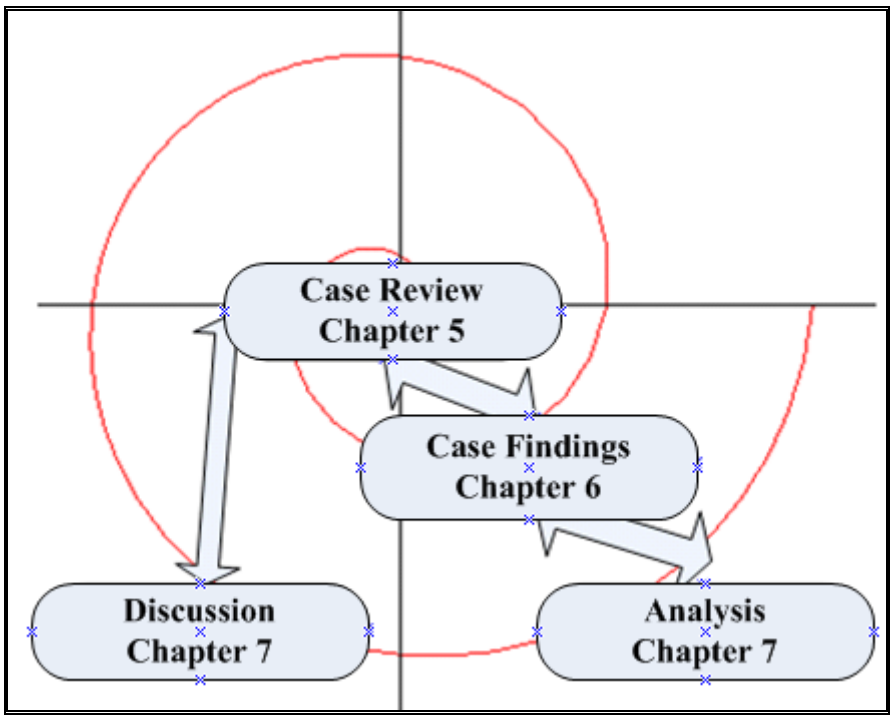


Figure 6: Spiral Approach

The research applied a 'Spiral' approach' mentioned in Carroll & Swatman, (2000) in conducting the review (Chapters 5-6), analysis and discussion (Chapter 7). According to section 4.2.3.4, Chapter 5 vertically presents the interview data case by case and Chapter 6 takes a further step in summarizing and classifying the research findings based on Chapter 5 and it is considered a horizontal approach in reviewing the interview data. Chapter 7 contains two parts: finding the answers to the research questions based on the findings from Chapter 6 and conducting comparative discussion based on the case review from Chapter 5.

Chapter 5: Case Review

The transcribed interview data are considered the raw data of the study, and it is used to present and summarize the main opinions of the participants in two ways: vertically – in Chapter 5 and horizontally in Chapter 6.

The raw data – the interview text, is attached in the Appendices. Since the interview content is considered confidential, the company name as well as the interviewee's name is not be written anywhere in the study. The researcher cannot present any information which may make it possible to guess the organizations in the study. Therefore, information that may betray the organization in the case has been deleted or modified in both the 'Case Review' chapter and Appendices.

Table 11 is a description of the five conducted interviews. The researcher then represents the main opinions in the five conducted interviews.

Table 11: Case Description

	Date and Time	Business Type	Position	Comment
Interview 1	March 9, 2007 10:00-10:40	Internet Service Provider	General Manager Information Systems	One further email contact
Interview 2	March 9, 2007 13:00-14:00	Network Operator	Client Activation Network Inventory Specialist	One further face-to-face contact
Interview 3	March 16, 2007 9:30-10:00	Internet Service Provider	Wireless Solution Manager	One further email contact
Interview 4	March 23, 2007 15:15-13:45	Network Operator	Marketing Manager – Wireless Office	No further contact
Interview 5	March 22, 2007 10:30-11:00	Internet Service Provider	Technical Specialist	No further contact

The review process in this chapter follows the presentation of the interviews giving all answers from each case to the interview questions. Chapter 6 – Research Findings will quote the data from Chapter 5, therefore the researcher uses tables for presenting the data in this chapter, which makes it easier to conduct a horizontal review process in Chapter 6.

5.1 Interview Question One

Could you please explain the role of your company in the telecommunication and Internet market?

Question one is concerned with the introduction of the business and its related services. All answers to interview Question 1 introduce the interviewees, companies and their Internet services, thus this information will not be presented in this section, although the researcher may use some of the information in other sections of the study.

5.2 Interview Question Two

Could you please briefly describe the telecommunication and Internet market mix in New Zealand?

The answers of all participants to interview Question 2 are presented in Table 12:

Table 12: Answers to interview Question 2

Case 1	1. New Zealand's broadband is primarily *DSL* and the biggest share of the DSL market in New Zealand is covered by Telecom with its '*copper wires*' in the ground. 2. Companies like Telstra Clear, who has small urban areas of coverage with infrastructure in the ground - primarily 'fiber'.

	3. The majority of the New Zealand's Internet market is served by Telecom's DSL and the copper wires. 4. The majority of sales in the broadband market in New Zealand are made by Telecom and the ISPs who are reselling Telecom's Internet services. However, companies like 'Woosh Wireless' are not reselling Telecom's services.
Case 2	1. New Zealand has four major telecommunication service providers - 'Network Operators', Telecom New Zealand, Vodafone, Telstra Clear and Vector New Zealand. 2. Vector New Zealand is an energy service provider which owns some fiber networks for telecommunication purposes. 3. The main competition is between the network operators; normally the ISPs are not involved to front-line competition, because they are reselling the services and products of the major players. 4. In some areas, the major players in the market are essentially working co-operatively with each other, because no one is able to provide services that cover the whole country. For instance, Telecom is the main competitor of Telstra Clear; however, Telstra Clear is Telecom's largest client. **Sub Question:** *Do you think that competition in the telecommunication and Internet market exists between the network operators that you mentioned?* 5. Different companies have different roles in the industrial area, for example, the network operators (for example, Vodafone, Telecom and Telstra) are competing with each other at a higher level, and the smaller ISPs (for example, iHug, Slingshot and Xtra) are competing with other ISPs at a lower level. 6. The small ISPs do rely on the larger network operators to provide the infrastructure and technology; without the support from the larger players, the smaller ISPs cannot reach their customers.

	7. ISPs in New Zealand are like service resellers, they primarily focus on customer service, not too much on the technology side. 8. Unlike some ISPs, Woosh is different because they provide wireless services; it does not rely on the traditional infrastructure; and the company can reach customers directly.
Case 3	1. Telecom is the PSTN (Public switched telephone network) provider, so all ADSL services have to be on the Telecom network. Also, Telecom is the only organization that uses CDMA technology. 2. Vodafone is a GSM network provider; it is the major competitor of Telecom in the mobile market. 3. Telstra has its own fiber optic network in certain areas such as Wellington and Christchurch. 4. ISPs are providing different services, such as ADSL, wireless, mobile and so on, so they have to rent from or cooperate with the network owners. 5. Service providers and network providers are different parties. As ISPs now have a chance to put their DSLAM machines into Telecom's exchanges, so they can provide their own DSL service. But of course, currently they still essentially have to rely on the network providers (for example, Telecom).
Case 4	1. The Internet market has three main players: Telstra Clear, Vodafone and Telecom. Vodafone was not in the 'top three' of the Internet companies until it starts the co-relationship with iHug (an ISP). 2. Internet service providers (for example, Orcon, Worldnet) resell services and solutions provided by the larger players, and some ISPs are presently building their own networks (for example, Woosh, Slingshot). 3. The majority of the Internet market and competition is shared by the three main players: Telecom, Vodafone and Telstra Clear. 4. New Zealand has an open market, therefore new opportunities are always offered to smaller players who are not in the top three. Currently, some ISPs have started building their own networks, providing their own services and having more

	control of the services that they provide. **Sub Question:** *Do you mean the market is changing?* 5. The market is becoming more competitive, and it will become more competitive with issues like local loop unbundling. 6. In wireless broadband competition, Vodafone has not been in this market as long as Telecom, but both companies have almost the same number of customers. 7. The competitive market allows some companies (for example, Vodafone) to become a completely and separate alternative to Telecom in the wireless and mobile broadband market.
Case 5	1. Vodafone and Telecom share the mobile market. 2. There are three major players in the Internet market: Telecom (DSL single player), Vodafone and Telstra Clear (Fiber). 3. Woosh Wireless is an ISP which is currently expanding the wireless network and is focused on wireless broadband. 4. Woosh and Call Plus intend to build their own networks; therefore they are no longer reselling the services or solutions of the larger players in the market. 5. In the DSL market, no one can compete with Telecom. The ISPs, such as Orcon, Worldnet, are located in the lower level of the market as they are DSL resellers.

5.3 Interview Question Three

Do you think that Internet competition has moved from fixed-lined Internet to mobile / wireless Internet?

The answers of all participants to interview Question 3 are presented in Table 13:

Table 13: Answers to interview Question 3

Case 1	1. Not Yet. 2. Wireless and mobile broadband is absolutely the way of future, it is exactly the same step from the landline at home to mobile phones, and this change is a long process. 3. At the moment, the market and users are probably between 1/3 to 1/2 ways along the path from fixed-line to mobile broadband. 4. Fixed-line broadband is always faster, but mobile and wireless broadband is a lot more friendly and usable when people do lots of moving works. 5. The speed of the fixed-line and wireless are both going up, as long as wireless broadband is fast enough to do the job people want to do; then mobile Internet will become a better option to fixed-line broadband.
Case 2	1. Not yet, but it will be happen in the future. 2. There is a trend towards wireless and mobile, and the telecommunication industry is in a transformation period at this time. 3. The telecommunication sector is moving from traditional business models to future business models. 4. In the traditional environment, there are large underground infrastructures such as copper, fiber or other types of physical media. 5. When mobile and wireless technologies are well developed, everything will be wireless and mobile. The power of mobility allows people have internet services 'anywhere' and 'anytime'. **Sub Question:** *Do you mean this trend is happening now and will continue to happen?* 6. Absolutely, and it will happen quickly. Mobile competition really impacts business strategies in the telecommunication sector. 7. For instance, Telstra Clear plans to build the third mobile network, which means 'mobile' and 'wireless' is becoming something important that the telecoms

	companies will look at.
Case 3	1. Yes. 2. Comparing the price of wireless broadband in the last three years, it is dropping. 3. There is a trend is towards wireless and mobile Internet getting the market. The trend is happening now and the competitive Internet market is opening up to new mobile and wireless. 4. Fixed line service will not disappear until far into the future due to its stability and performance; but mobile and wireless will achieve 'anywhere availability'.
Case 4	1. No. 2. The Internet competition is more on the fixed-line side than mobile and wireless side, but that mostly from the service perspective rather than functionality or price, because price is entirely controlled by Telecom at the present time. 3. From the service perspective, there is lot of competition and bundling is going on with services that try to be more attractive. 4. There is no serious competition in the fixed-line side, so the price is not going to change too much. However with wireless, the only real competition is between Vodafone and Telecom. 5. Although there are some ISPs and other service providers with different services in the country, only Telecom, Vodafone and Woosh have good national penetration and service availability. **Sub Question:** *Do you think that the market in New Zealand is a price driven market?* 6. Consumers are always price driven; this will be the same everywhere. Wireless and mobile Internet services will follow the route of fixed-line broadband services.
Case 5	1. Not really at this time. 2. Mobility indeed offers convenience to users, and the users can use broadband access and connectivity without any limit on location.

	3. When people choose between fixed-line broadband and mobile broadband, they normally chose fixed-line because it is faster and more stable. Users choose mobile or wireless broadband when they want to move or when fixed-line Internet is not available. 4. As the number of customers for mobile Internet is not as high as for fixed-line broadband, the main competition is still with the fixed-line broadband. 5. Mobile and wireless will definitely be well accepted and deployed, but this is a slow process from the fixed-line to mobile. 6. Bundling of fixed and mobile is critical for ISPs in the future. In particular, the FMC (Fixed and Mobile Convergence) strategies highlight the opportunity and importance of providing both fixed-line and mobile services.

5.4 Interview Question Four

Does your company offer or plan to offer mobile Internet services? If the answer is yes, could you please briefly describe the service and its deployment?

Question one is concerned with the description of mobile and wireless broadband deployment and service. The answers to this question may allow the reader to guess the participants, thus information will not be presented in this section, but the researcher may use some of the information in other sections of the study.

5.5 Interview Question Five

In your opinion, what specific requirements does a mobile Internet deployment model need to meet in order to fit into the New Zealand market and meet customer expectation?

The answers of all participants to interview Question 5 are presented in Table 14:

Table 14: Answers to interview Question 5

Case 1	1. The New Zealand market is quite different from the Australian market, and the New Zealand market is really price driven. No matter what you offer, you have to have good price. 2. In general, the most important requirement of mobile Internet is bandwidth. If mobile broadband intends to compete with DSL and fiber, it is required to have larger pipes and higher speed. 3. As long as the wireless pipe is big enough and fast enough for people, people would like to use wireless and mobile broadband because mobility is a 'plus' feature. 4. It is actually quite hard to spend a lot of time, money and effort to build up a national wireless network in New Zealand. Therefore there is a strong barrier to new players coming into the mobile market.
Case 2	1. The most important requirement is speed – the 'bandwidth'. 2. The requirement is how service providers develop a technology or how they deploy the technology to meet the customers' wants. 3. The service providers should deploy services that are suited to the customers. 4. Promotion should be considered a requirement. **Sub Question:** *Do you think that mobility is also an important factor to customers?* 5. The industrial sector has changed a lot as well as human behavior. 6. In the old days, people use fixed-line internet, and nowadays people want to have mobility and use mobile Internet. 7. Some technologies such as VPN, wireless and mobile Internet connections make this possible. Due to mobility, people can continue working 'anywhere'.
Case 3	1. Mobile Internet deployment should be customer focused. 2. Customers do not care about technology; they consider the price, the speed of connection, the coverage and the performance (for example, stability).

	3. If wireless access can achieve what fixed line can do at the same price level, wireless will get the market.
Case 4	1. Performance is a key requirement to mobile Internet deployment. 2. Mobile Internet deployment has to stay alive and gain experience from fixed-line broadband deployment. 3. The speed, reliability of coverage, reliability of the service and the price are the important requirements of mobile Internet deployment. 4. Although most people use the service, there is not at the moment a big need to have more applications than currently exist.
Case 5	1. Mobile Internet is an innovative concept for both the service providers and consumers. The cost of deployment should be considered because the equipment is expensive. 2. Price is the most important feature that an Internet user primarily looks at and compares. Apart from that, coverage, bandwidth, speed, performance, perhaps customer service is also important when deploying Internet service to end users. 3. While different service providers offer the same level of performance in service, customers would like to compare the price; in contrast, if the service providers are offering service at the same price level, customers will look at the quality of service and performance.

5.6 Interview Question Six

Several technologies are available to deploy mobile Internet services presently; could you please give me some personal ideas about the strengths and weaknesses of each deployment model?

The answers of all participants to interview Question 6 are presented in (Table 15):

Table 15: Answers to interview Question 6

Case 1	**1. CDMA** ● CDMA technologies are not the best solution for the future. ● The CDMA networks have low capacity, thus mobile applications and services (for example, mobile Internet) will never be driving the market. ● There are some revisions coming along to the CDMA networks and the related improvements are set on the CDMA networks; however CDMA is no longer the best technology for offering wireless and mobile broadband. ● Service providers do not wish to use technology (for example, CDMA) that is not the best for the future. In addition, it costs a lot to upgrade the CDMA network. **2. WiFi** ● WiFi offers mobility and people can have wireless connection within a particular location, for instance, in the office. ● WiFi is not a suitable solution for building a network with a large coverage (for example, city-space or national-space). ● WiFi is a suitable option to provide Internet access in small locations, such as airports, coffee shops, libraries and so on. **3. WiMax** ● WiMax is new and good, but this technology being deployed for Internet service in New Zealand is quite far away. ● WiMax cannot deliver what people expect until: 1) the equipment becomes faster and cheaper; 2) people understand the technology better; 3) optimization techniques allow the cell sites to deal with different kinds of check-out processes. ● "Intel" says that the chips they built for mobile devices (for example, laptops) will support WiMax in 2008. WiMax equipment is expensive at this time.

	● At this stage, it is much friendlier to have WiMax-enabled devices and service providers can sell WiMax services to customers. ● WiMax will become better than the current technologies in a couple of years, and service providers should start thinking about 'WiMax' now. ● It costs a lot to build WiMax cell sites and roll up a mobile network. ● WiMax deployment a radio spectrum and buying that spectrum from the New Zealand government. ● The government has constantly changed the rules in terms of reallocating the spectrum. ● When huge amounts of money are spent on building the WiMax networks, the service providers can only earn for example $20 per customer per month, it seems that adopting WiMax is a long term development.
Case 2	**1. CDMA** ● Based on the existing infrastructure, Telecom's CDMA network displays some limitations in deploying mobile Internet service. ● CDMA relies on the copper lines which has negative impact on network performance. **2. WiFi** ● WiFi is based on the IP-based network; mobile devices can access it by connecting to access points. ● WiFi is available within a small and limited service range; therefore WiFi is not a recommended for deploying Internet service in large areas. **3. WiMax** ● WiMax is the next generation in wireless technology. ● WiMax equipment is currently produced by specific manufacturers such as Nokia and Intel.

	● WiMax equipment is currently expensive; therefore it is not cost-effective to deploy WiMax service in New Zealand unless the cost goes down. ● WiMax is a long-term solution for wireless and mobile development. **Sub Question:** *Do you think that WiMax will take the place of CDMA/WCDMA in the future in New Zealand?* ● WiMax is not mature enough compared to WiFi and WCDMA/CDMA, but it will be established after 2010. ● WiMax comes from the IP background; it does not come from the traditional telecommunication background. ● When WiMax is adopted in the future, the old infrastructure will change, as well as the services provided. ● WiMax is a technology that primarily contributes to the NGN, the next generation network, because WiMax achieves a pure Internet protocol environment. ● Old technologies (for example, WiFi or CDMA) will not be given up in the short term, because they still have customers and a place in the market.
Case 3	1. CDMA has wide coverage in New Zealand, but it is active only in New Zealand, thus it may not be used to roam in other countries. 2. WiFi and WiMax are new worldwide standards, but they are still not very common on mobile devices (for example, cell phone).
Case 4	**1. CDMA** ● The main disadvantage of CDMA is few companies are focused on developing applications and services in handsets with CDMA technologies. ● Although CDMA has some advantages such as, greater coverage with a lower number of base-stations and having less air interface; CDMA does not have a good future in the mobile development process. **2. WiFi** ● WiFi has good inter-portability, which means a lot of devices understand WiFi

	technologies. ● The weaknesses of WiFi from the Telecoms' perspective are it is not a high cost area to enter the market and everyone can deploy WiFi services and solutions. ● WiFi has a smaller service range; therefore a huge number of access points are required when WiFi is used to deploy large area wireless Internet service. ● In the mobile environment, there is no transaction between users and base stations; people need to break a connection and get a new connection in the WiFi environment if they want to move and continue working. **3. WiMax** ● WiMax has wider coverage; therefore it requires a lower number of cell sites deploying services over the large areas. ● Base stations support multiple-technologies (for example, WiMax, CDMA, and UMTS) and deliver multiple-services. ● WiMax will become the major technology in the Internet space and compete with CDMA and W-CDMA in the near future.
Case 5	**1. CDMA** ● CDMA and WCDMA are currently the leading technologies in New Zealand. ● CDMA and WCDMA have the potential to be updated, and there is a long development process in mobile network evaluation. ● CDMA and WCDMA technologies are not the best solution for the future. The main problem with them is the huge cost of upgrading. ● Sometimes, even when a huge amount of money is spent, the improvement in network performance is not as much as expected **2. WiFi** ● WiFi is not a good solution for mobile services because it is very difficult to build a large area wireless network with WiFi. ● WiFi is not a cost-effective and technically-effective solution.

	● WiFi could be used in particular areas such as in an office, coffee shops and so on. ● WiFi networks are popular because they have comparatively higher speed of connectivity and better security than CDMA networks. ● WiFi network has comparatively less mobility than CDMA networks. **3. WiMax** ● WiMax is a good solution for mobile Internet service deployment in the near future. ● WiMax is considered a big event after 3G, and WiMax is positioned between 3.5G and 4G in wireless and mobile evolution. ● WiMax has just started to be used to deploy commercial Internet solutions in New Zealand. ● The WiMax solution is cost-effective because WiMax has better coverage and it also achieves better speed and performance. ● Some companies in the country are currently looking at WiMax for deploying Internet and wireless service in the near future.

5.7 Interview Question Seven

Do you think mobile Internet will contribute to the convergence of networks, technologies and services? Try and if so, how?

The answers of all participants to interview Question 7 are presented in Table 16:

Table 16: Answers to interview Question 7

Case 1	1. New Zealand has two mobile phone standards, they are the Telecom standard and the Vodafone standard. 2. Mobile phones are almost the same; however there is a small radio frequency difference between the phones work on the Telecom and Vodafone networks. 3. The mobile phone producers normally standardize 95% of the mobile phone and

	place the 5% difference on the chip. 4. New model mobile phones have one chip with different frequencies, and two slots for different networks (Vodafone and Telecom). **Sub question:** *Why do we have that?* 5. In certain areas in New Zealand, Telecom‘s service is available, and Vodafone’s service is not available. The mobile phone can detect which network has the stronger signal and use that. 6. Customers only want things that work at a lower price; therefore, this smart function on the mobile phones will be advantageous to them. 7. Mobile devices have several connecting methods or multiple-technologies. For example, a laptop with WiMax (will be available on the Intel chip), WiFi (most chips are familiar with WiFi), a DSL network port at the back; as well as Bluetooth technology. There are four methods by which the laptop could be connected. 8. At the end of the day, the person sitting down does not care as long as they can browse the Internet. People never care about which services and technologies are used as long as Internet services are available to them. 9. During the process of network convergence, mobile devices will become smarter at connecting different networks and working seamlessly.
Case 2	1. Mobile Internet significantly impacts on the current technologies and it drives the convergence process. 2. Voice over IP combines the Internet with telephones; Television over IP combines television with the Internet. 3. When ‘mobile technologies’ are concerned, those mentioned above will become something like mobile voice over IP or mobile TV over IP. 4. The end users mobile services on have been widely deployed in the financial sector (for example, mobile payment, credit card services) 5. Mobile Internet significantly contributes to the convergence of networks and

	technologies.
Case 3	1. A hybrid solution may emerge to support wireless and wired technologies at the same time. For instance, a computer can have a LAN port and a wireless port. 2. A more extreme solution would be an auto sensing device which could choose the best network according to the environment.
Case 4	1. Mobile Internet drives convergence. 2. Once people realize that they are not able to have Internet access in some locations, mobility becomes more significant. 3. New mobile entry will require a huge initial cost. 4. Comparing fixed-line broadband and wireless / mobile broadband, another benefit of mobility will be when people want to move. 5. 'Mobile' and 'Wireless' broadband is the 'anywhere' Internet.
Case 5	1. The convergence of networks is in progress, mobile Internet is the key to opening the door of convergence. 2. Mobile Internet is contributing to convergence of networks presently and mobile Internet is a service that links mobile networks and the Internet together. 3. Both mobile networks and the Internet can currently supply mobile Internet services; mobile Internet can be offered through different technologies, such as CDMA/GSM, WiFi and WiMax. 4. A single access protocol suite will run the future network and the old technologies such as CDMA/GSM, WiFi or WiMax will disappear. 5. Currently multiple-networks with multiple-technologies are available; the next step is a single access platform with multiple-technologies; the final step of Internet evolution will be a single access platform with single access protocol. 6. The concept of mobile Internet is leading the move from 'multiple-network with multiple-technology' to 'single network with multiple-technologies'. 7. Services delivered should meet customers' needs. 8. Networks and technology may influence the performance of the service; but it will not have a significant impact on the types of service.

	9. For instance, Internet is a kind of service, it can be deployed by different methods, but no matter how Internet becomes available, Internet related services (for example, email, online banking) are offered.

5.8 Interview Question Eight

Could you please describe how mobile Internet will deliver end user services based on the converged networks and technologies?

The answers of all participants to interview Question 8 are presented in Table 17:

Table 17: Answers to interview Question 8

Case 1	1. It is hard to guess future end user services and applications. 2. There are a lot of mobile specific applications, for example, GPS systems on mobile phones. 3. There are lots of services that do not exist at this moment, however they will exist in the near future when people wish to pay for and use them.
Case 2	1. Most companies will have the experiences to design and deliver end user services when the convergence process matures. 2. There is quite a successful mobile service in Japan nowadays; a mobile phone can be used as a credit card, or a mobile phone is combined with credit card services. 3. Based on the converged networks and technologies, mobile Internet may deliver end users services mostly dependent on two criteria: service availability and customers wishing to use the service. 4. Once Internet service is merged with mobile technologies, the Internet will become a main feature of mobile phones, and the mobile phone will be the mobile device that allows customers to have Internet access anywhere.
Case 3	1. A cell phone which supports GSM, CDMA, WiFi, WiMax and GPS services may exist very shortly. 2. In terms of mobile Internet, people would use a cell phone just like using a

	computer with its Internet service. 3. A cell phone is not only used for making phone calls and sending messages anywhere, but having Internet access and Internet service anywhere, as long as mobile services are available, the Internet service will be available.
Case 4	1. Fixed-line and mobile convergence is a big issue that should be carefully considered. Service providers can learn from the experience of fixed line Internet. 2. People can share the same bundle of usage between both 'fixed' and 'mobile' Internet. 3. There are a lot of issues in the convergence process, for instance the 'voice client' and 'message client' on the mobile network are currently sent over Internet broadband service. **Sub Question:** *Do you think that in the future, everything, no matter whether it is on the mobile network or Internet will be IP-based?* 4. The future network may purely be based on Internet protocols, or purely layer 2, it is likely to become IP-based in the near future. 5. Some organizations are involved in network architecture to IMS standard, which allows higher inter-portability between IP and fixed networks or mobile networks. 6. It separates the mobile applications from the mobile signal into two separate layers, thus there is a core network to deliver access between the fixed-line access points to the wireless access points. 7. Within some current network structures, there are a range of signaling and service control boxes, and these plugs into a range of applications on top. This means people can talk to an IP sub-switch, or the IP PBA-switch, or another courier, or customers with IP, and that is directly interacting with the mobile network. **Sub Question:** *Do you think the current bandwidth is large enough the supply mobile TV service?*

	8. If you are looking at standard TV, the bandwidth involved is very low. TV is a stream media; it does not require a lot of bandwidth.
Case 5	1. In the near future, a cell phone will be able to select networks in particular areas. For instance, in New Zealand, mobile devices could select from either Telecom's CDMA network, Vodafone's WCDMA network or Call Plus's WiMax network. 2. Mobile devices will be multiple-technology enabled, such as WiFi enabled, WiMax enabled and DSL enabled. 3. Users and devices can choose the best way of connecting to the Internet; they can also choose the best network and technology. 4. The end user services, for instance, M-mobile service, M-payment, GPS service are become popular nowadays in many counties; mobile solutions and applications are developed based on mobile devices and mobile Internet.

5.9 Interview Question Nine

What would be the most appropriate mobile Internet deployment model or solution for the New Zealand market based on your personal ideas and experience?

The answers of all the participants to interview Question 9 are presented in Table 18:

Table 18: Answers to interview Question 9

Case 1	1. The New Zealand market is currently 1/3 of the way along the path from fixed-line Internet to mobile Internet, most companies do not push mobility side as much as the price side at the moment. 2. The deployment model will change over the time, as the technology improves, coverage improves, and the price will go down. 3. A good deployment model should be able to attract as many users as possible. 4. A mobile Internet deployment model should educate people. For instance, some older people started using computers in the last 10 years and using the Internet in

	the last 5 years, they felt like using these new technologies because the deployment model had educated them on how to use the technology.
Case 2	1. WiMax is perfect for deploying mobile Internet in New Zealand, because it is designed for metropolitan networks has faster speed and wider range. 2. WiMax can support an approximate 60 kilometers range, thus it is a cost-effective way to build a nationwide WiMax network. 3. WiMax is suited to the New Zealand market because New Zealand has large city areas but a small population. **Sub Question:** *If WiMax is a good solution for the country, do you think a pure WiMax model is suitable or a network containing WiMax and other technologies, such as CDMA and WiFi?* 4. The old technology will not disappear quickly; perhaps 3G and 4G technologies will run on the same network in the near future, because some customers will still use the old technologies to connect to the network that is based on 4G mobile technologies. 5. A suitable deployment model should consider the affordability to both customers and the service providers. 6. Service providers cannot sell the $20,000 equipment to customers because no one can afford the price. 7. Service providers cannot spend billions of dollars building a network for only one million users. **Sub Question:** *Do you think the New Zealand market is a price driven market? Do you think that customers don't really care what technologies they use, and only care how much the services cost more than any other feature?* 8. Lower price is always attractive to customers. For example, if the price of the

	service goes down, more customers would like to use the service. 9. Service providers should offer professional customer service. 10. Price is very important, but user acceptance and adoption are the critical success factors of mobile Internet deployment models.
Case 3	1. A hybrid model may be needed to cope with different situations. 2. However, as stated previously, price is very important.
Case 4	1. Within 10 years, the current networks (for example, WiMax, CDMA, and UMTS) will be converged to a single access platform. 2. There will not be a big difference between service providers to access the network; all mobile devices will connect to the same access platform. 3. The difference will be in the access layer, things like CDMA, UMTS, WiMax and WiFi will disappear in the future 4. There will be a single access protocol suite running on the network and everyone will be able to talk to this access protocol in the future. **Sub Question:** *If what you mentioned will happen in the future, how would protocols, such as CDMA, WiFi or WiMax, disappear?* 5. Some protocols are disappearing in the near future. For example, Vodafone's UMTS will go to the next generation wireless technology, which is close to WiMax. 6. In fact, WiMax standards are adopting GSM and some signaling protocols. Therefore, WiMax and GMS will become closer and closer. 7. The network being deployed may not have different types of access methods. **Sub Question:** *Do you think there is a large development cost for this change?* 8. The convergence process is not something that is going to happen or something be planed; it depends on the technical availability and user behaviors.

	9. The future access protocols are currently being proposed and designed. 10. In the future, everyone's mobile device will be able to access the single platform.
Case 5	1. Something good will overtake CDMA, UMTS, WiFi or WiMax in the future. 2. WiMax would be a suitable mobile Internet deployment solution for New Zealand. 3. WiMax fits the requirements in terms of 'mobility', 'cost-effectiveness', 'performance' and 'customer expectations'. 4. WiMax will take advantage of competition with the current mobile technologies (for example, CDMA or WCDMA) in the near future. 5. WiMax offers opportunities to the smaller players in the market and WiMax will become a major competitor with the CDMA technologies, 6. The CDMA players do know that CDMA is not a long-term solution. 7. The CDMA players are making hard decisions about giving up CDMAs and using something new (for example, WiMax).

5.10 Conclusion and Recommendations

The vertical review process initially summarizes the main opinions from the respondents, the structure of the vertical review allowed the researcher to make a comparative analysis and provide a discussion in Chapter 7. The next Chapter describes the research findings as a horizontal review process of the interview data.

Chapter 6: Case Findings

Chapter 5 reviews the interview data from a vertical approach; this Chapter takes a further step in the review process. The researcher analyzes and summarizes areas mentioned as the interview findings and applies a horizontal approach in presenting the research findings.

Seven themes are classified from the data presented in Chapter 5 as follows and the researcher takes an initial data interaction process in this Chapter:

1) Market structure
2) Mobile Internet and its impacts
3) Customers
4) Deployment requirements
5) Deployment technologies
6) Future trends
7) Most suitable solution

The themes outlined above are built based on the review process in Chapter 5, thus the researcher will point out the evidence from Chapter 5 that supports the findings in this chapter, using the structure 'Chapter number . Table number. Case number. Statement number'; for example, *5.14.2.1*.

The case reviews presented in Chapter 5 and the case findings presented in Chapter 6 will contribute a final answer to the research questions in Chapter 7 - Analysis and Discussion.

6.1 Market Structure

This section describes the market structure, mainly using two business models: the network operators (major players) and the Internet service providers (minor players). Internet competition and the market environment are also examined.

6.1.1 Business Model

All participants agree that there are two main business models in the Internet and telecommunication market. The network operators - who own the large underground and wireless infrastructure, are considered the larger players in the market. They offer extensive Internet solutions and customer service nationally, own the most of the market share and lead the front line competition in the New Zealand market.

As stated in Chapter 5, Table 12, there are only four network operators (at the higher level) in the country: ***Telecom New Zealand*** is a typical multiple-service provider in the market and it has the biggest DSL share, provides wireless broadband, hotspot service and 3G mobile services around the country. ***Telstra Clear*** has small urban areas of coverage with infrastructure in the ground - primarily with fiber; ***Vodafone*** has its business focused on mobile services, it started its cooperation with iHug (an ISP) and entered the DSL competition in 2005. ***Vector New Zealand*** is an energy service provider that owns some fiber networks for telecommunication purposes.

Apart from that, there are lots of Internet service providers, known as the minor players in the Internet market. Most of these smaller businesses do not have their own networks or infrastructure; they primarily resell services and solutions from the larger players. The smaller Internet service providers are not involved in the front line competition; they are positioned at a lower level in the market.

6.1.2 DSL Monopoly

According to Chapter 5 Table 12, Telecom New Zealand does not have any competitors in the DSL market. The majority of New Zealand's Internet market is

served by Telecom's DSL and its copper wires underground. Therefore the DSL market has been known as a monopoly in the last few years.

Most of the Internet service providers (the minor players) resell DSL services from Telecom; in fact most Internet service providers are not really pleased to be Telecom's service resellers, because the competition between the resellers (smaller ISPs) is serious, but the price is totally controlled by Telecom. According to *5.12.5* therefore, some Internet service providers are trying to quit the Telecom's control and build their own networks, in order to become more competitive and offer their own services (for example, Woosh Wireless and Slingshot / Call Plus).

According to *5.12.2.5*, the two major network operators (for example, Vodafone and Telstra Clear) are in a similar situation, although they are primarily mobile services and fiber technologies, they are not able to entirely leave Telecom's control. In many fields, they are cooperating with Telecom's copper infrastructure in order to reach their customers, and they are in fact major clients of Telecom New Zealand.

The next section describes mobile Internet and its impact on the market and users.

6.2 Mobile Internet and its Impact

Mobile Internet indeed proposes a huge impact on the market environment, as well as on users. This section examines how mobile Internet provides those impacts.

6.2.1 Benefits of Mobile Internet

According to *5.13.2.5* and *5.13.5.2*, mobility indeed offers convenience to Internet users. Mobile Internet users can have Internet access and connectivity without limitation in location, which means that 'anywhere' Internet services are available within service coverage. Comparing fixed-line Internet and mobile Internet, the core benefit of mobility is when people want to move – see *5.13.1.4*.

For instance, if someone uses fixed-line Internet and wants to move, he/she has to call the Internet service providers and tell them about the move, get them to prepare a new connection, pay them to install the modem, and wait for few days. On the other hand, if someone using mobile Internet and wants to move, what he/she needs to do is, pick up the unit and move it to the new location, plug in the equipment, and then Internet services are available as normal. The same advantages can be applied to the other situations (for example, working off site, studying and so on).

According to *5.13.2.2* and *5.13.5.5*, mobile and wireless Internet will be well accepted and deployed in the near future, and there is a slow adoption process from the fixed line to mobile. When people choose one from fixed-line Internet or mobile Internet, they normally use fixed-line because it is faster and more stable, see *5.13.1.4*. The only thing that might push people to use mobile or wireless broadband is 'mobility', see *5.13.2.5*; when people want to move, when fixed-line Internet is not available in particular areas, then mobile Internet is the best option.

6.2.2 Fixed-line Internet to Mobile Internet

Four of five participants believe that wireless and mobile broadband is definitely the way of future; it is just like the move from landline telephones at home to mobile phones, see *5.13.1.2*; however it is a long process from fixed line Internet to mobile Internet. In *5.13.1.3*, participant 1 mention that the market and users are still probably 1/3 to 1/2 of the way along the path from fixed-line to mobile and wireless broadband.

6.2.2.1 Mobility

According to *5.13.3.4*, fixed line Internet service will not be given up entirely until far into the future, because fixed line Internet services provide better stability and performance (for example, bandwidth). On the other hand, mobile and wireless can offer 'mobility' that allows users to have Internet access without being limited by

location. Therefore, fixed-line Internet is always faster and more stable, but mobile Internet is more users friendly and convenient when people do the moving works.

6.2.2.2 Price

Looking at the price of mobile Internet services offered over the last three years, it is constantly dropping, which can be taken to mean that the mobile Internet market is competitive. In terms of technical improvement, the speed of the fixed-line and the mobile Internet are both growing, see *5.13.1.5*. As long as mobile Internet service is fast enough to do what people expect, mobile Internet will become a better option to fixed-line Internet. However, the adoption process from fixed-line Internet to mobile Internet is not complete at this time.

6.2.2.3 Competition

Presently, Internet competition is more on the fixed-line side than the mobile and wireless side. However, participant 4 mentioned in *5.13.4.2* that this had happened mostly due to service rather than functionality or price, because price was still controlled by Telecom New Zealand. From the point of view of service, a lot of competition and some events like 'local loop unbundling' have made Internet services become more attractive, and customers who want a change from Telecom's service may consider using these services, see *5.13.4.3*. Moreover, there is no serious competition in fixed-line Internet service, because the price has not changed a lot, as Telecom controls the prices offered.

However in the mobile and wireless market, the only real competition is currently between Vodafone and Telecom as they control the mobile sector, mentioned by participant 3 in *5.13.3.5*. Although some Internet service providers are planning to offer mobile service and mobile Internet service, only Telecom and Vodafone have superior national penetration and service availability. Small ISPs need to expand their service coverage and networks in order to compete with these two companies, and this may happen in the near future.

According to *5.13.5.6*, bundling of fixed and mobile services is likely to be critical for ISPs in the future when the technologies really converge. In particular, the FMC – 'Fixed and Mobile Convergence' Strategies (FMC Strategies, 2007) highlight the opportunity and importance of providing both fixed-line and mobile services. As long as wireless access can do what fixed line can do at the same price level, wireless can take the market; however, that will be a long process.

The move from fixed-line Internet to mobile Internet has two main impacts which will be explained later; *section 6.2.3* - the Internet market becomes more competitive; *section 6.2.4* - the transformation of the telecommunication sector.

6.2.3 Competitive Market

The main DSL competition is between the network operators (larger players); normally the smaller ISPs are not involved in front-line competition, as they are reselling the services and products of the major players in the market. However, the market will become more competitive because of issues like the FMC strategies and LLU (local loop unbundling).

According to *5.12.3.5*, although the network operators and service providers have different roles and positions in the market environment, with LLU, everyone (major and minor players) have the opportunity to store their DSLAM machine on Telecom's exchange sites, then they can provide their own DSL service to customers. This situation means the DSL monopoly era is over, Internet service providers can offer their own DSL service to customers. The DSL price is still controlled by Telecom, but ISPs are no longer the service resellers of Telecom and the DSL (fixed line Internet) market becomes competitive, also see *5.12.4.5*.

In terms of mobile and wireless competition, there is a long-term trend towards wireless and mobile Internet will gain the Internet market, see *5.13.2* and *5.13.4*. The trend is a slow process at this time but the competitive Internet market is open to 'mobile' and 'wireless new entries. Telecom was the single player in the DSL market; however, where mobile and wireless are concerned, other players (for example, Vodafone and Woosh) are competing with Telecom.

Participant 4 gives an example in *5.12.4.7*; the competitive mobile Internet market allows Vodafone to become a completely separate alternative to Telecom. In terms of mobile Internet, Vodafone has not been in the market for a long time as Telecom, but Vodafone has almost the same number of customers as Telecom. The mobile Internet market is competitive.

6.2.4 Telecommunication Sector Transformation

In *5.13.2,* participant 2 mention that there is slow adoption process from fixed-line Internet to mobile Internet; this process will lead to the transformation of the telecommunication industry. At the present time, the telecommunication sector is transforming from traditional business models to future business models. The service range and the value chain model within the telecommunication sector are changing, the roles and responsibilities of the value chain players are changing, and the services offered to customers are changing.

In the traditional environment, there are large underground infrastructures such as copper, fiber and any other types of physical media. When mobile and wireless technologies are well developed, the services offered will be focused on mobile and wireless. Finally mobile Internet will take the place of fixed line because people would like to work with Internet services 'anywhere' and 'anytime', this is the power of mobility.

However, these new connections will not take the place of the existing underground infrastructure unless mobile and wireless performance is as good enough to meet all the technical requirements and customer expectations. Therefore, the traditional infrastructure will not be given up in the near future during this transformation process in the telecommunication sector.

6.2.5 Barrier to Deploying Nationwide Services

In *5.14.1.4* and *5.16.4.3*, both participant 1and 4 mention that there is a strong barrier for new entry companies to deploying nationwide service, because it requires a huge amount of investment to build a new nationwide network in New Zealand. The population of the country is small, and so it is not a cost-effective way to deploy new nationwide Internet or mobile services to customers. Although some ISPs (for example, Woosh and Callplus) adopt new technologies such as TDD-UMTS or WiMax to supply services, the main market is still controlled by the larger players (network operators such as Vodafone, Telecom and Telstra), minor players will not get a piece of the main market until they have the nationwide network and services.

6.2.6 Opportunities for Small Businesses

Telecom is the only player in the DSL market. Due to the shift from fixed-line Internet to mobile Internet, the New Zealand market will become more competitive. Both challenges and opportunities are offered to the smaller ISPs in changing their market positions, see *5.13.5.6*. The minor players in the market can start offering their own DSL service due to LLU, minor players can also build mobile or wireless networks in order to compete with the large players in the wireless sector. For example, Woosh Wireless and Call Plus/Slingshot are building the own network, they are no longer reselling the services or solutions from the larger players in the market, see Chapter 5 Table 12. .

According to *5.18.5.5*, New Zealand has an open market; new technologies always bring opportunity to smaller companies. For instance, WiMax will become a major

competitor to the current 3G technologies and some ISPs are planning to use WiMax to compete with the larger players in the market, see *5.15.4.3*. It is very interesting to hear that, some major players (for example, Telecom, Vodafone and Woosh) will consider WiMax as an option for offering wireless and Internet services. Definitely this will be a headache to the businesses that need to give up the 'CDMA network' and use WiMax.

6.2.7 Mobile Internet Impact on Business Strategies

According to *5.13.2.6*, mobile Internet competition indeed impacts on the business strategies of the telecommunication companies. For instance, Telstra Clear plans to build the mobile network, which means 'mobile' and 'wireless' must become something more important that the telecoms companies need to consider, see section 3.3.1.2. The smaller Internet service providers (for example, Woosh Wireless and Call Plus/Slingshot) are also currently expanding their networks and service coverage, in order to leave the DSL monopoly and move their focus to mobile and wireless, see Chapter 5 Table 12 and 13. Moreover, Telecom New Zealand is trying to work out how to gain better competitive advantage in 3G competition, and it will surely meet larger challenges in 4G wireless competitions.

The next section describes the customers' behavior and expectations in using mobile Internet services.

6.3 Customers

The customer is a core element in the research framework (*section 4.1.4 – Figure 4*), the customer (end user) is the target market of mobile Internet deployment; therefore, it is very important to understand the customers' needs, behaviors and expectations. This section is focused on investigating customers.

6.3.1 Price-Driven or Customer-Driven?

According to *5.14.1.1*, the New Zealand market is quite different from the Australian market in that it is really price driven, services offered to customers should be at a good price. For example, customers will not use something good but extremely expensive, therefore price of services should be affordable to customers. Apart from the price driven market, consumers are also price driven because price is the most important factor that consumers look at initially, see *5.14.5.2*. For example, if the price of the service goes down, the service can attract more customers.

However in the long term, service providers should not only apply a low price strategy to get more customers, but also try to keep existing customers. Therefore, the quality of Internet service and customer service are the factors that service providers should carefully consider. According to *5.14.2.2*, the requirement is how service providers develop a technology or how they deploy the technology to meet the customers' wants. The market and customers are price driven, mobile Internet deployment is customer driven; because customer acceptance is the critical success factor of the mobile Internet deployment process, customer adoption is the actual value that achieves business goals.

6.3.2 Customer Behavior and Expectation

Price is the most important feature that an Internet user may look at primarily and compare. Where local loop unbundling is concerned, the speed of fixed-line Internet will increase and the price of the Internet services will decrease. On the other hand, mobile and wireless Internet services are currently not too focused on the price (although customers are price driven), but focused on service. For instance, coverage, bandwidth, service performance and customer service are being considered when customers plan to use mobile Internet services, see *5.14.3*.

Customers do not consider the technologies used a lot, they are sometimes price driven. Customers usually compare the price of the Internet services where similar

quality of service is offered. In contrast according to *5.14.5.3*, customers like to compare other features (for example, quality of service, performance and customer service) when the price of the services are at the same level. In order to understand consumer behavior and meet their expectations, mobile and wireless Internet service can follow the experience of the fixed-line Internet deployment process.

The next section examines requirements of mobile Internet deployment in New Zealand.

6.4 Requirements of Deployment

One of the most important requirements of mobile Internet is ***bandwidth,*** because this requirement will never be met, see *5.14.1.2*. If mobile broadband intends to compete with DSL and fiber, it is required to have larger pipes and higher speed. As long as the wireless pipe becomes big enough and fast enough, mobile and wireless broadband will be well accepted since mobility is the 'plus' feature. Apart from that, the offered '***price'*** is a key requirement to mobile Internet deployment; as mentioned previously in section 6.3, the market and consumers are always price driven.

According to the summarized data presented in Chapter 5, Table 14, mobile Internet deployment has to stay alive and gain experience from the fixed line Internet deployment process. After ***speed of connection*** is considered, the ***reliability*** of ***coverage*** and ***reliability*** of the ***service*** are necessary factors that need to be considered when deploying mobile Internet service.

Moreover, a very significant requirement will be how service providers develop a technology or how they deploy the technology to ***meet customers' wants and expectations,*** mentioned by all participants**.** For instance, different mobile Internet service plans (for example, Vodafone's or Telecom's) are offered to particular customer segments; when customers' demands change, the service plans offered will change.

The industrial sector has changed a lot and so too has ***human behavior***. Formerly, people used fixed-line internet, and at the present time people want to have mobility because they can work and have Internet access via mobile devices anywhere within service coverage. According to *5.14.2*, technologies such as VPN (virtual private network), mobile and wireless Internet connections make the anywhere-Internet come true. With mobility, Internet users are able to work continually in different locations or in a more relaxed environment.

Furthermore, mobile Internet is an innovative technology for both service providers and consumers. The ***cost*** of the deployment should also be considered because building a nationwide mobile network requires huge amount investment, see *5.14.5.1*. Apart from that, ***promotion*** will be part of mobile Internet deployment, because the promotion strategy for the Internet service is the bridge that connects the deployment model and customers, see *5.14.2.4.*

Finally, participant 1 point out that we cannot ignore that a successful deployment model should be able to ***educate*** people who are not familiar with the services and technologies, see *5.18.1.4*. Some older people started using computers in the last 10 years and the Internet in the last 5 years; they felt like using the new technologies because the deployment models educated them about how to use computers and how to access the Internet.

6.5 Strengths and Weaknesses of the Technologies

According to Chapter 3 and Chapter 5 Table 15, CDMA, W-CDMA, WiFi and WiMax are the technologies that are currently available to deploy mobile Internet service in New Zealand; this section summarizes the strengths and weaknesses of each technology.

6.5.1 CDMA and W-CDMA

Three participants describe CDMA as having the potential to be updated and a long development process for mobile networks. The advantage of the CDMA network is that it requires fewer base-stations to get a greater coverage, because CDMA requires less air interface. On the other hand, the main problem of CDMA is the huge cost of the upgrading process. Even when a huge amount of money is spent, the improvement in network performance is not as good as would be expected. Another disadvantage of CDMA is fewer applications and services are developing for handsets with CDMA technology. Therefore, although CDMA is the current leading mobile technology in the New Zealand market, it is not the best mobile and wireless solution for the future.

Vodafone's W-CDMA technology has similar problems to CDMAs (for example, the high cost of updating). However, the W-CDMA is a next generation wireless technology, which is close to WiMax technology, because WiMax standards are adopting GSM and its signaling protocols. Apart for that, more developers build applications and mobile services on the W-CDMA platform, thus, W-CDMA has a comparatively better future than CDMA in the New Zealand market.

6.5.2 WiFi (IEEE 802.11)

All participants describe WiFi as based on the IP (Internet protocol) network; mobile devices can have Internet access by connecting to access points. WiFi gives the feeling of mobility and Internet users can have Internet access and connectivity within WiFi coverage. In addition, WiFi bas better interpretability than other technologies and most current devices (for example, mobile phones, PDAs or laptops) understand WiFi technology. Furthermore, WiFi is good because it has higher connectivity speed of and better security.

WiFi is only available within smaller or limited service coverage, normally WiFi can only reach 100 meters; therefore WiFi can be used to provide Internet access in

smaller areas such as cafés, offices, and bus stations. Therefore WiFi is not the most cost-effective or technically effective solution in deploying Internet service in citywide or nationwide. However, as mentioned in section 3.3.2, the WiFi community - FON, building its mesh network worldwide is an option in deploying mobile Internet services.

6.5.3 WiMax (IEEE 802.16)

WiMax is a next generation technology. According to *5.15.1.3* and *5.15.2.3* described by both participant 1 and 2, WiMax equipment is presently very expensive, only some manufacturers such as Nokia and Intel are producing WiMax equipment; therefore it is not a cost-effective way to deploy nation-wide WiMax service in New Zealand unless the cost of the equipment goes down, as customers may not wish to pay more for the equipment. In *5.15.5.3,* participant 5 believes that WiMax is a cost-effective way of deploying mobile services in the future.

WiMax specification issues mean that it will never deliver what customers expect until, see *5.15.1.3*:

1) the equipment become cheaper;
2) people understand WiMax better;
3) optimization techniques allow the cell sites to deal with different kinds of check outs.

Therefore, WiMax will not be suitable for deploying Internet services for at least a couple of years.

According to *5.15.2.3*, it is predicted that WiMax will be full deployed by 2010. WiMax technology is not mature enough compared with existing WiFi and WCDMA/CDMA technologies. Since WiMax comes from the IP (Internet protocol) background, it is close to the proposed next generation network (the pure IP environment), everything on the NGN contains an IP. The telecommunication industry is in a period of transformation. There is a trend for the fixed-line Internet to

move to the wireless and mobile Internet services, and also a trend for the socket-based network to move to the packet-based network. However, these older technologies will not be removed or disappear easily, so in the near future, WiMax, WiFi and CDMA/W-CDMA will be compete with each other in the NGN environment.

According to *5.15.4.3*, WiMax is good but it has similar limitations to WiFi. WiMax has a broader reach, and it doesn't cost as much to deploy services and technologies. A base station may support multiple-technologies (for example, WiMax, CDMA, and UMTS) and deliver multiple services. Since WiMax had the wider coverage and lower deployment cost, it may become the main platform in the Internet space and in the medium term in the mobile space competing with CDMA and W-CDMA in the future.

To sum up, WiMax is probably an excellent technology and solution for the future Internet service. In fact WiMax is considered as the next big thing after 3G, between 3.5G and 4G in wireless and mobile evolution. WiMax has just started deploying commercial solutions in New Zealand. WiMax is easy to deploy and cheap to deploy; it can achieve better coverage; it can achieve better speed and performance. Some telecommunication companies in the market will look at WiMax to deploy Internet and wireless services in the near future.

6.6 Future Trend

Most participants believe mobile Internet and wireless connectivity are the future trends from the technological perspective; this section investigates how mobile Internet impacts future technologies, devices and services.

6.6.1 Mobile Internet and the Convergence Process

According to the data presented in Chapter 5 Table 16, the convergence between stationary Internet and the mobile network is presently occurring. Mobile Internet is a

service that links mobile networks and the stationary Internet and it brings a significant impact on the current technologies and pushes the convergence process.

Currently the New Zealand market has multiple-networks and multiple-technologies; the next step is a single access platform with multiple access protocols; the final step in Internet evolution is likely to be a single access platform with a single access protocol. At this moment, mobile Internet is leading the way from multiple-network and multiple-technology to single access platform and multiple access protocols. Therefore, three of five participants believe mobile Internet is not only contributing to the convergence process, it is actually the key opening the door to the converged network.

6.6.2 Future Networks and Technologies

In the future, the network model may be purely IP-based or purely layer 2; however it will most likely be based on Internet protocol in the short term, see *5.17.4.4*. For instance, some companies are involved in Network architecture to IMS standard; this standard allows higher and better interoperability between Internet protocols and fixed line or mobile networks.

According to *5.16.5.4*, it is predicted that a single access protocol suite will run on the future network and the existing technologies such as CDMA/GSM, WiFi or WiMax will disappear in the future. However the old technologies will not suddenly disappear; 3G and 4G protocols will run on the same access platform, because some customers will still use those technologies.

Within 10 years, the current networks (for example, WiFi, WiMax, CDMA, and GSM) will become a single access platform, see *5.18.4.1*. There will not be a big difference between providers and access to the network; all devices can be connected to that single access platform. Protocols like CDMA, UMTS and WiMax and WiFi will disappear in the future and a single access protocol suite that is currently being

proposed and designed will run on the future network. Everyone will be able to use this protocol and access the single platform. Therefore, the real difference in the Internet environment of the future will be presented in the services offered to customers, see *5.18.4.2*.

6.6.3 Future Mobile Devices

At the extreme end there will be an auto-sensing device which can choose the best network according to the environment. In the near future, a cell phone will be able to select networks in a particular area, see *5.16.1*. For instance, in New Zealand, mobile devices will be able to select from either Telecom's CDMA network, Vodafone's WCDMA network or Call Plus's WiMax network. Mobile devices will be built with multiple-technologies enabled, such as DSL enabled, WiFi enabled and WiMax enabled.

In terms of mobile Internet, according to *5.17.3.3*, people would use a cell phone just as they use a computer now for Internet service. A cell phone is not only used for making phone calls and sending messages anywhere, but having Internet access and related services anywhere, as long as the mobile services are available, the Internet service is available.

6.6.4 End User Services on the Converged Network and Technologies

It is difficult to predict what applications are available in the future. There are lots of services that do not exist at this moment, which will exist in the near future when users wish to pay for and use them, see *5.17.1*.

Presently, most companies have the experience to design and deliver end user services while the convergence matures, see *5.17.2*. Based on the converged networks and technologies, mobile Internet may deliver end users services mostly dependent on two factors: availability of services and customer appeal. Once Internet services merge

with mobile technologies, the Internet will become a main feature of mobiles, and mobiles are the devices or platforms that will allow customers to have Internet access.

According to *5.16.5*, in the Internet environment of the future, no matter what platform and technologies will be used; services offered will be more dependent on customers' wants. The network and technology will only affect the performance of the services; service types will not be affected. For instance, Internet is a kind of service; it can be deployed by several methods. When Internet is available, no matter how Internet becomes available, Internet-related services (for example, email, online banking) are offered and available to end users.

6.7 Most Appropriate Deployment Solution

According to section 1.2 – Research Objective, the researcher intends to propose the most appropriate mobile Internet deployment model as the final objective of the conducted research project. The most suitable solution is considered a research implication and is stated in section 7.2 later on. This section briefly summarizes some issues related to the most appropriate deployment model from the interviews. The evaluation of the appropriateness of a deployment model will be presented in both business perspective and technological perspective.

From a ***business*** point of view, a deployment model changes over the time, as the technology improves, the coverage and the bandwidth will improve, and the price will go down. In terms of the deployment model, getting broadband in the hands of as many New Zealanders as possible and educating people on how to use the new services and solutions is important.

From a ***technological*** point of view, WiMax is perfect for deployment in New Zealand because it is designed for metropolitan networks with a faster speed and wider range than any current technologies. WiMax can support an approximate 60 kilometer range, thus it is a cost-effective way to build a national network, as the

distance between one cell-site to another is large. It is suitable for the New Zealand market because New Zealand has large city areas but a small population, see Chapter 5 Table 15.

Price and cost should be balanced; the deployment model should be concerned with the ***affordability*** to customers, while also being profitable to the service providers, see *5.18.2.5*. For example, you cannot sell $20,000 equipment to a customer because no one wishes to use it. A service provider will not spend billions of dollars building a network for one million customers.

To sum up, a suitable deployment model should meet all the requirements mentioned in section 6.4, also it should be able to take care of customers; making sure all the equipment, technologies and services are provided at a comparatively low price.

6.8 Conclusion and Recommendations

The research findings described in Chapter 6 are drawn from Chapter 5 (Case Review and summarize the opinions of the respondents on particular points and present them as research findings. The next chapter ‘Analysis and Discussion’ will look at the answers to the research questions drawn from the review presented in Chapter 5 and the findings presented in Chapter 6.

Chapter 7: Analysis and Discussion

Following on from Chapter 5 - Case Review and Chapter 6 - Case Findings, in this chapter the researcher tried to find answers to the defined research questions and also discuss the implications of the research. An additional literature review was undertaken, with the purpose of offering supportive evidence to the research findings and the answers to the research questions, and a comparative approach was applied for the analysis and discussion process.

7.1 Answers to the Research Questions

There were three research questions formulated in the methodology section, those research questions were primarily concerned with three main areas:

1) *Deployment requirements of mobile Internet;*
2) *Contribution of mobile Internet to the convergence process;*
3) *Future end-user services.*

The researcher aims to find the answers to the research questions based on the data presented in Chapter 5 and Chapter 6. The researcher views the interview data as primary data provided by the participants, while the findings are interpretations and add the actual value that make a contribution to the research questions and the thesis.

7.1.1 Deployment Requirement Analysis and Discussion

Research Question 1 was to determine mobile Internet deployment requirements from two perspectives:

1) Fitting into the New Zealand market and competition;
2) Meeting users' expectations and behaviors.

Section 7.1.1.1 describes the telecommunication and Internet market environment in New Zealand and section 7.1.1.2 examines consumer behavior in regard to choosing and adopting Internet services.

7.1.1.1 Market Environment

According to the findings in section 6.1, this section describes the market structure and how mobile Internet impacts on the business environment, for example, business models, competition and opportunities.

There are two major business models in the Telecommunication and Internet market in New Zealand: network operators (larger players) and Internet service providers (smaller players). Formerly, the major competition was between the network operators, because they owned large infrastructures and offered extensive products and services to New Zealand consumers, see section 6.1.1. For example, Telecom New Zealand is the sole DSL supplier and controller in the country and no one can compete with it. In contrast, the smaller players (Internet service providers) do not have their own networks or infrastructure, they are reselling products and services from the larger players.

At the present time, based on the findings in section 6.1.2, the telecommunication and Internet market is becoming competitive and the DSL monopoly era is ending. Issues like FMC - Fixed and Mobile Convergence strategy (Vrdoljak, Vrdoljak & Skugor, 2004) and LLU - Local Loop Unbundling Strategy (Leporelli & Reverberi, 2004) encourage the New Zealand telecommunication and Internet market to contain multiple providers, multiple solutions and multiple technologies.

Mobile and wireless Internet provides opportunities for smaller and minor players in the Internet market. Kallio et al (2006) describe the challenges and opportunities for mobile telecommunication operators in Germany as the convergence process approaches. According to section 6.2.6, a number of the smaller players are presently planning to change their roles from resellers to service owners in the Internet and telecommunication sector. For example, Woosh Wireless (an ISP) is building its own wireless network and offers wide-ranging wireless solutions in major New Zealand cities; Callplus (an ISP) is adopting the innovative WiMax technology and

implementing a trial in the Whangarei and North Auckland region, with an nationwide network is in process.

Based on the findings in section 6.2.5, from a practical point of view, especially for a new entrant, no one will want to put copper to build infrastructure in the ground, because that does not make sense, the cost to deploy it is too high. In terms of mobile deployment, the feasibility of the service is good and the cost is relatively low. However, it is also quite hard to spend a lot of effort, time and money to build up a national wireless network in New Zealand, as New Zealand has small population and a competitive Internet market, Therefore there is a strong barrier to new players coming into the mobile market (New Zealand Ministry, 2000).

According to section 6.2.2, mobile Internet service providers should carefully consider what the requirements and circumstances of the Internet market in New Zealand are before deploying mobile Internet services. Bundling of fixed and mobile is likely to be critical for ISPs in the future before the technologies really converge. Both major and minor players can obtain better competitive advantage if they choose appropriate mobile Internet deployment strategies. Therefore, mobile Internet deployment models have to be tightly focused on the market environment.

To sum up, the move from fixed-line Internet to mobile Internet has three impacts on the New Zealand environment:

1) it makes the Internet market more competitive, the DSL monopoly era is ending;
2) it leads to the transformation of the telecommunication sector based on the FMC strategy (fixed and mobile convergence);
3) it provides opportunities for the minor players in the market.

The New Zealand market environment is unique and specific; the mobile Internet value chain players have to carefully consider the market environment and market

requirements in order to maintain the best direction in deploying mobile Internet services.

7.1.1.2 Consumer Behavior

Considering the competitive market environment descried in the previous section, this section examines mobile Internet user requirements and consumer behavior based on the findings in section 6.2 and 6.3. The researcher assumes that mobile Internet consumers throughout the world are having similar behavior. Therefore, the results of this section can be applied to other countries.

According to section 6.3.1, the New Zealand market is not only competitive, but also price driven, as price is the most important factor that consumers would initially look at (Koch & Cebula, 2002). Therefore if the price of the service goes down, the offered service may attract more customers. Normally, consumers like to compare the price of Internet services of the same level, on the other hand, when the prices of the services are the same, consumers like to consider other features, such as quality of service, customer service and performance (Chae et al, 2002).

According to section 6.2.1, Mobile Internet is currently being accepted and adopted by more and more people because mobile Internet actually brings convenience to people's lives (Akkeren & Harker, 2003). However, when people choose between fixed-line broadband and mobile broadband, they will normally use fixed-line because it is faster and more stable. The main thing that might push people to use mobile or wireless broadband is when they want to move and fixed-line Internet is not available (Fogelgren, 2005).

Based on the findings in section 6.2.2.1, mobility offers convenience to users, and the biggest advantage of using mobile Internet is that users can have broadband access and connectivity without being limited in location (Sun, Howie & Sauvola, 2001). Comparing fixed-line broadband and wireless / mobile broadband, the core benefit of

mobility can be seen when people want to move, see section 6.2.1. However, mobile Internet will not entirely take the place of fixed-line Internet in the near future because the fixed-line Internet has larger bandwidth and better stability than mobile Internet (Tee, 2005, p.236). Performance (for instance, bandwidth) of mobile Internet and fixed-line Internet is improving at the same time, see section 6.2.2.2, which means the expected bandwidth offered by fixed-line Internet is always going to be larger than the bandwidth of mobile Internet. Users will give up using fixed-line when mobile Internet can meet their bandwidth demands; however the bandwidth of Internet service has yet to meet users' expectations (Clarke, 2001).

To sum up, the mobile Internet service deployment process can follow in the steps of the fixed-line broadband service deployment process (Ken, 2001; Bui & Jeffery, 2006), in order to answer consumers' behavior and meet customers' expectations. User acceptance is the primary factor that denotes mobile Internet deployment success, user adoption is the major value that contributes to business goals. Therefore, mobile Internet deployment models have to be tightly focused on end users.

7.1.1.3 Requirements of mobile Internet Deployment

According to section 6.4 – 'Requirements of Deployment', in this section the requirements of mobile Internet deployment are concentrated in two areas: the market (section 7.1.1.1) and customers (section 7.1.1.2); and further classified into three categories: price, QoS-QoP (Quality of Service and Quality of Performance) and customers.

Figure 7 demonstrates and explains the relationship between the two areas and three categories of mobile Internet deployment requirements.

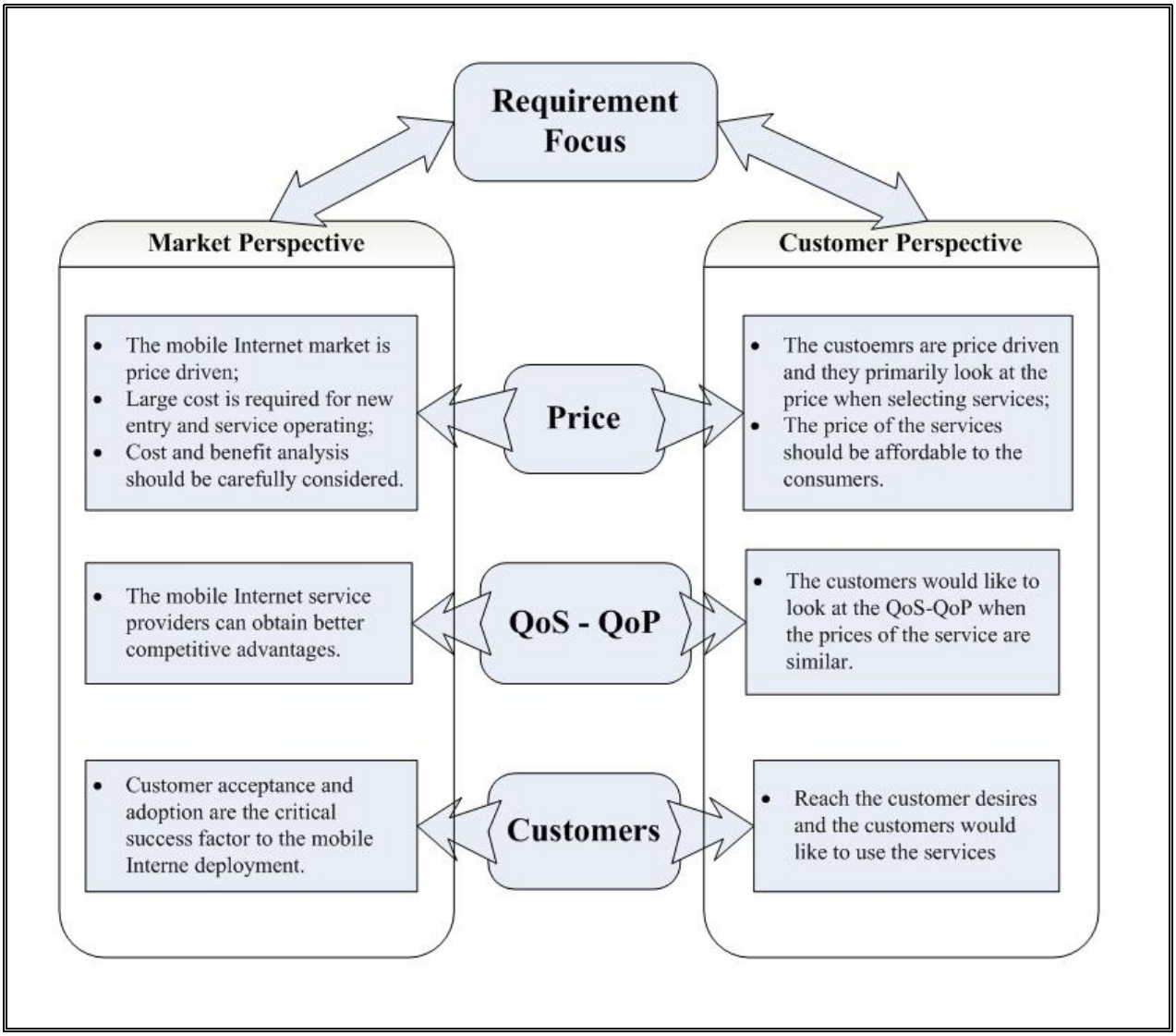


Figure 7: Mobile Internet Deployment Requirements in New Zealand

Price is a very important requirement in mobile Internet deployment because both the market and customers are usually price driven; the price of the products and services should be affordable to consumers. The cost of deployment should be carefully considered by the service providers.

Quality of service and performance are also important because customers would like to look at the QoS-QoP when the prices of the services are similar; in order to achieve lasting success, mobile Internet service providers should maintain comparatively high quality service and a high standard of performance; therefore QoS-QoP is extremely important in long term business competition and the strategy planning process.

Furthermore, mobile Internet deployment is really ***customer driven***, because customer acceptance and adoption are the critical success factors to mobile Internet deployment, therefore, the deployment models should meet customers' wants and expectations.

In summary, Figure 7 describes and explains that the three requirement categories are closely linked to both the market perspective and the customer perspective. Also the three requirement categories are equally important to mobile Internet deployment strategies.

7.1.1.4 Comparative Discussion

Following on from the previous section, this section investigates the purpose of the requirements and the meaning of the requirements in a case-comparative manner; therefore the data presented in Chapter 5, Table 14 is applied to this section.

Table 19 lists all mobile Internet deployment requirements mentioned by the five respondents: *Note: Price Focus (R1 and R2); QoS-QoP Focus (R3, R4, and R5); Customer Focus: (R6, R7 and R8).* **"√"** means the requirement was mentioned in the case study.

Table 19: Requirements Mentioned in the Cases

		Case 1	Case 2	Case 3	Case 4	Case 5
R1	**Price of the Product and Service**	√	√	√	√	√
R2	**Cost of deployment**	√	√	√	√	√
R3	**Bandwidth – Speed of Connection**	√	√	√	√	√
R4	**Coverage – Mobility**	√	√	√	√	√
R5	**Reliability – Security**		√	√	√	√
R6	**Customer Service**	√	√	√	√	√
R7	**Educating Users**	√				
R8	**Promotion Strategy**		√			

Price, QoS-QoP, and customers are the three focuses defined in the last section (see Figure 7). Obliviously, most of the requirements (price of the product and service; cost of the deployment, bandwidth, coverage, reliability, and customer service) are mentioned by at least four participants out of five. It is interesting that 'educating users' (mentioned by participant 1) and a 'promotion strategy' (mentioned by participant 2) are requirements of a mobile Internet deployment model, see *5.14.2.4* and *5.18.1.4*.

In terms of educating users, in order to get prospective customers to move from fixed line to mobile, the deployment model needs to demonstrate the advantages of using mobile Internet. If users do not know much about mobile Internet, then demonstrating the advantages might actually mean educating the prospect as to what can be done on the mobile Internet. For example, a sales drive based around giving free community based introductions to mobile Internet. Indeed, while deploying a new service to users, it is better to let users understand benefits of the deployed service, rather than just selling products and services to them. Moreover, promotion can be part of the deployment, because the promotion strategy links the deployed service to customers, educating users can be an initial stage of the promotion strategy.

7.1.1.5 Summary

Section 7.1.1 examines mobile Internet deployment requirements and provides the answers to research question one. The result of the investigation on mobile Internet deployment requirements presented in Figure 7 can be applied to other countries or market environments, without heed to governmental policies and legislation.

7.1.2 Convergence Process Analysis and Discussion

Research Question 2 was to investigate how mobile Internet contributes to the convergence process, including the convergence of networks and technologies. This

section describes the participants' opinions of the convergence process based on the findings in sections 6.5 and 6.6, the relation between mobile Internet and the convergence process and also future networks and technology.

7.1.2.1 Driver of the Convergence Process

According to Chapter 5, Table 16, three participants believed that mobile Internet is not only contributing to the convergence process, but also the driver in converging stationary Internet and the mobile network. Figure 8 demonstrates the convergence process and the position of mobile Internet.

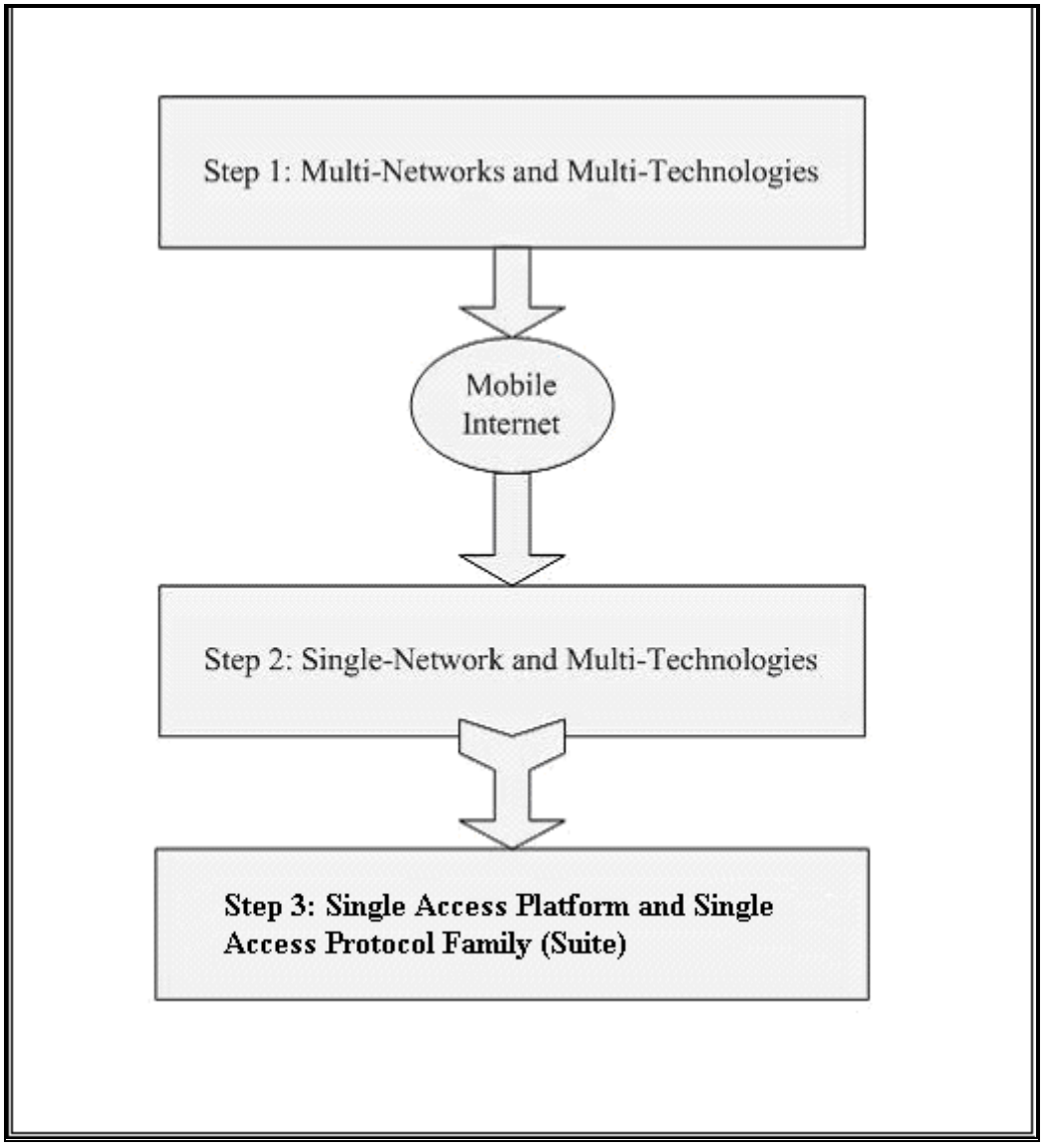


Figure 8: Mobile Internet and the Convergence Process

To sum up, mobile Internet has a significant impact on the telecommunication and Internet environment and is the key to initiating the convergence process; in contrast, the researcher believes that mobile Internet is an end user services that is produced by the convergence process. The next section describes the technology convergence process.

7.1.2.2 Network and Technology Convergence

According to section 6.6.2 and Figure 8 presented in the previous section, mobile Internet enables Internet service to become available on mobile devices it also drives the convergence between stationary Internet and mobile networks (Katz, 1998). At the present time, the New Zealand Internet and Telecommunication market has multi networks (CDMA, WiFi, WiMax, and GSM) with multiple access protocols (see Step 1 in Figure 8); the next step will be the single (converged) network with multiple technologies (see Step 2 in Figure 8). The final step of convergence process will be a single platform with a single access protocol suite. At this moment, mobile Internet is leading the move from multiple networks with multiple technologies to a single platform with multi access protocol (Willie, 2002, p.388).

Moreover, it is predicted that within 10 years, the current networks (for example, WiFi, WiMax, CDMA, and GSM) will converge to a single access platform – true network convergence (Agrawal & Famolari, 2006). There will not be a big difference between service providers and the access network; all mobile devices will be able to be connected to any network (Fodil, 2005). The only difference will be in the access layer, things like CDMA, UMTS, WiMax and WiFi will disappear. There will be a single access protocol suite (this has already been proposed and designed) running on the future network and everyone will be able to talk to that access protocol (Nikolaou et al, 2002). The participants predict that the NGN (next generation network) can be purely IP (Internet Protocol) based or can be perhaps ‘Layer 2 – Data Link Layer’ based (mentioned by participant 4 in section *5.17.4.4*). However, three participants

agree that the NGN will be based on Internet Protocol in the near future, see section 6.5.3 and 6.6.2.

7.1.2.3 Summary

In summary, when the convergence process is completed, there will be a single access platform and a single access protocol suite. These are the same features available to both the service providers and the end users. When Internet services become available through the mobile network and the mobile devices, the convergence process is initially starting; therefore mobile Internet drives the convergence process; on the other hand, the convergence process influences the mobile Internet development and deployment. According to section 6.2.2 and 6.6.4 the main competition will be focused on end user services offered over the converged network and technology. The next section describes the answers to research Question 3, which is concerned with the end user service and how the services are effectively offered.

7.1.3 End-User Services on the Converged Network

Research Question 3 was to investigate how mobile Internet would deliver end user services based on the converged network and access protocol. As mentioned in the previous section, 7.1.2.3, the competition between the service providers will be focused on delivering various end user services, because everyone can use the a single access protocol suite to connect to the networks on the single access platform. This section analyzes and discusses mobile devices, end user services and the best connection methods for the future network architecture.

7.1.3.1 Services over the Converged Network

As the convergence process matures, more and more end user services become available based on network convergence and mobile Internet. With reference to Chapter 5, Table 16 and Table 17, this section examines the current end user services on the converging networks and future end user services over a converged network

mentioned by all respondents. The researcher classifies them into four major categories, See Table 20 below:

Table 20: End User Services over the Converged Network – Case Review

Respondent	End User Service
Case 1	'Anywhere' Internet service (Internet Service) GPS service (Location Service)
Case 2	Credit card service (Financial Service) Voice service (Phone Service) TV service (Entertainment Service)
Case 3	GPS service (Location Service) 'Anywhere' Internet service (Internet)
Case 4	Voice Client (Phone Service) Message Client (Phone Service) TV over Mobile service (Entertainment Service)
Case 5	Mobile Payment service (Financial Service) Mobile Game service (Entertainment Service)

In the future Internet environment, no matter what platform or technologies will be used; the services offered are more dependent on customers' wants. The converged network and technology may affect the performance of the services but the service types may not be influenced. Based on the convergence between stationary Internet and mobile network, service providers offer end user services primarily in five areas: phone service, Internet service, location service (Zhao, 2002), financial service (Liu, Pang & Wang, 2005) and entertainment service (Petrova & Qu, 2006; Rautio, Anttila & Tuominen, 2007), see Figure 9:

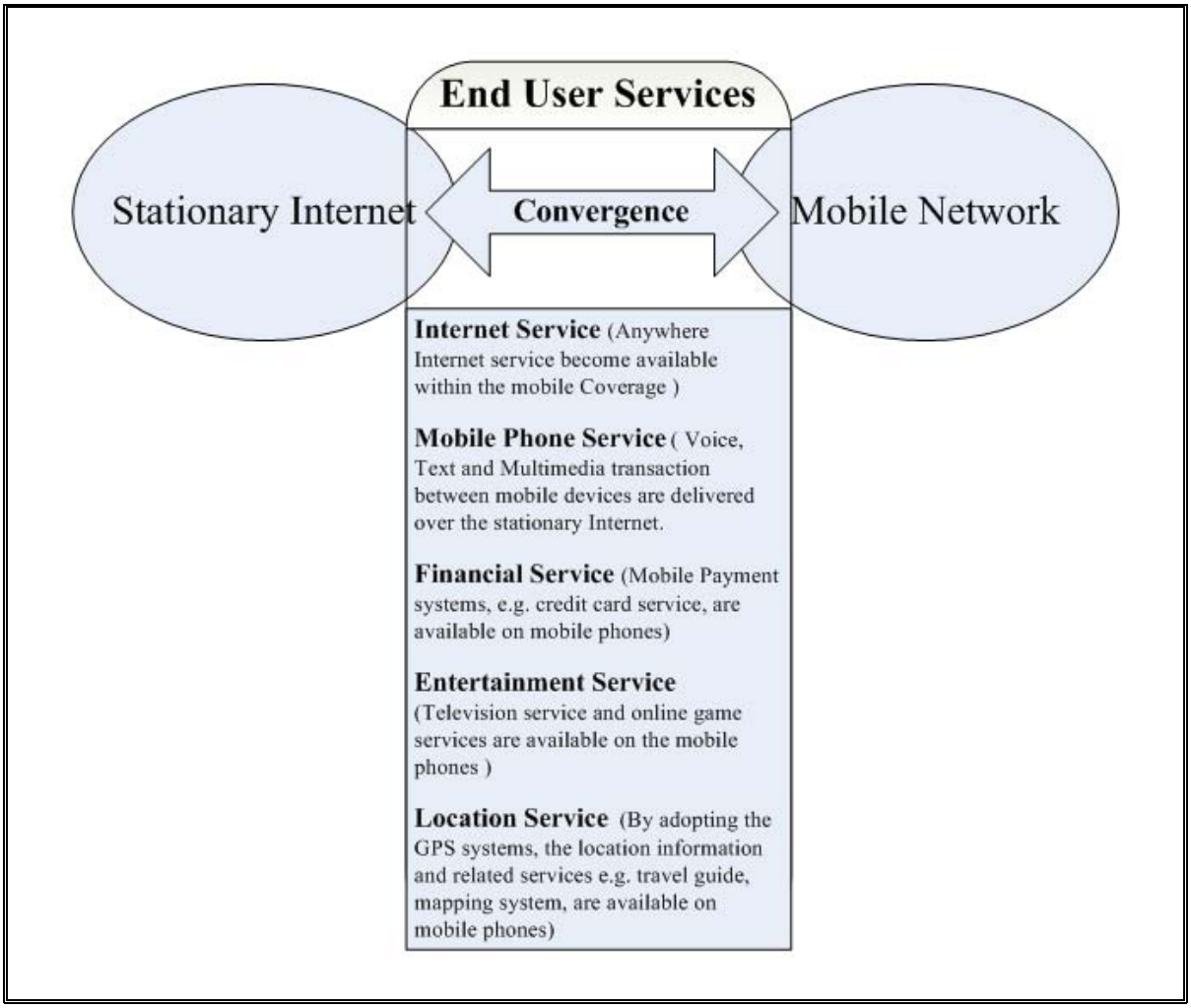


Figure 9: Service Categories and Network Convergence

In summary, mobile Internet initially drives the network convergence between the stationary and mobile network. The convergence process enlarges the service range and more end user services become available over the cooperation between stationary Internet and mobile network (converged network). Mobile Internet may deliver end users services mostly dependent on two considerations: availability and how attractive the services are to customers.

7.1.3.2 Current and Future Mobile Device

The end user services over the converged network are examined in the previous section. This section investigates mobile devices and how they will work in the network convergence.

According to the findings in section 6.6.3 and the data presented in Chapter 5, Table 16, there are two standards of mobile phone in New Zealand, Telecom and Vodafone. According to Morishita, Kim & Fujimoto (2003), mobile phone producers normally standardize 95% of the mobile phone and hide the 5% difference is on the chip (for example, radio frequencies). Future mobile phones will have one chip with different frequencies, and two slots for different networks (Vodafone and Telecom). It is proposed that mobile phones will automatically use a network in the future (for example, Telecom's CDMA network and Vodafone's W-CDMA network). This auto-detect service will ensure that the best mobile service (for example, best signal, best price rate and best location) are offered to customers.

When new technology (for example, WiMax) becomes available, when new services are required by customers (for example, GPS services), more functionalities and technologies will be merged on the mobile devices, a hybrid solution, mentioned by participant 3 in section 5.16.3.2. For example, a mobile device will have a chip that understands the CDMA network, the W-CDMA network, DSL, DSPS, WiFi, WiMax and perhaps Mobile-Fi (IEEE 802.20 – future mobile standard) , GPS system is enabled and the Bluetooth technology (a short range wireless connection within a local area) is available (See Figure 10).

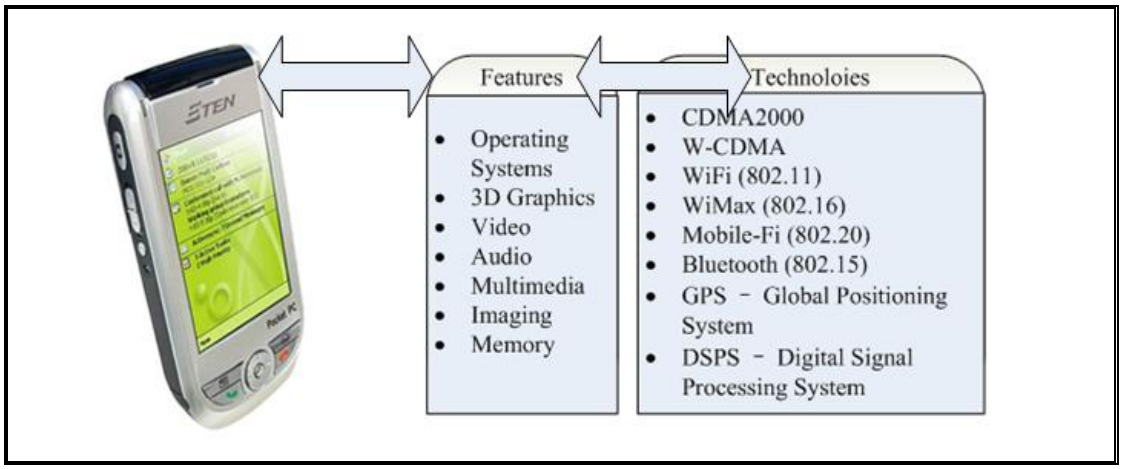


Figure 10: Future Mobile Devices – Features and Technologies

In summary, hybrid solutions and features will be integrated and available on future mobile devices. Smart devices will also maximize benefits for mobile users with automatic-detecting and automatic-selecting of the best network and technology. In some area, network and technology convergences lead to the device convergence – computer and mobile convergence. Mobile devices (for example, cell phone or PDA) are working as mini PCs with the availability of multiple features and functionalities at the present time. Some people may argue that the usability impediment decreases the quality of performance on the future mobile devices; however mobility should have better priority than usability or quality of performance, if users can complete their activities within the mobile Internet environment.

7.1.3.3 ABC Mobile Internet Environment

As defined in section 7.1.2 and 7.1.3, future mobile devices will understand several technologies; they will connect to the single access platform (the converged network) by service-detecting and service-selecting methods, in order to find the best Internet connectivity. ABC (Automatic and Best Connectivity) Mobile Internet environment (see Figure 11) demonstrates how to maximize mobile Internet usability and efficacy in the currently Internet environment in New Zealand.

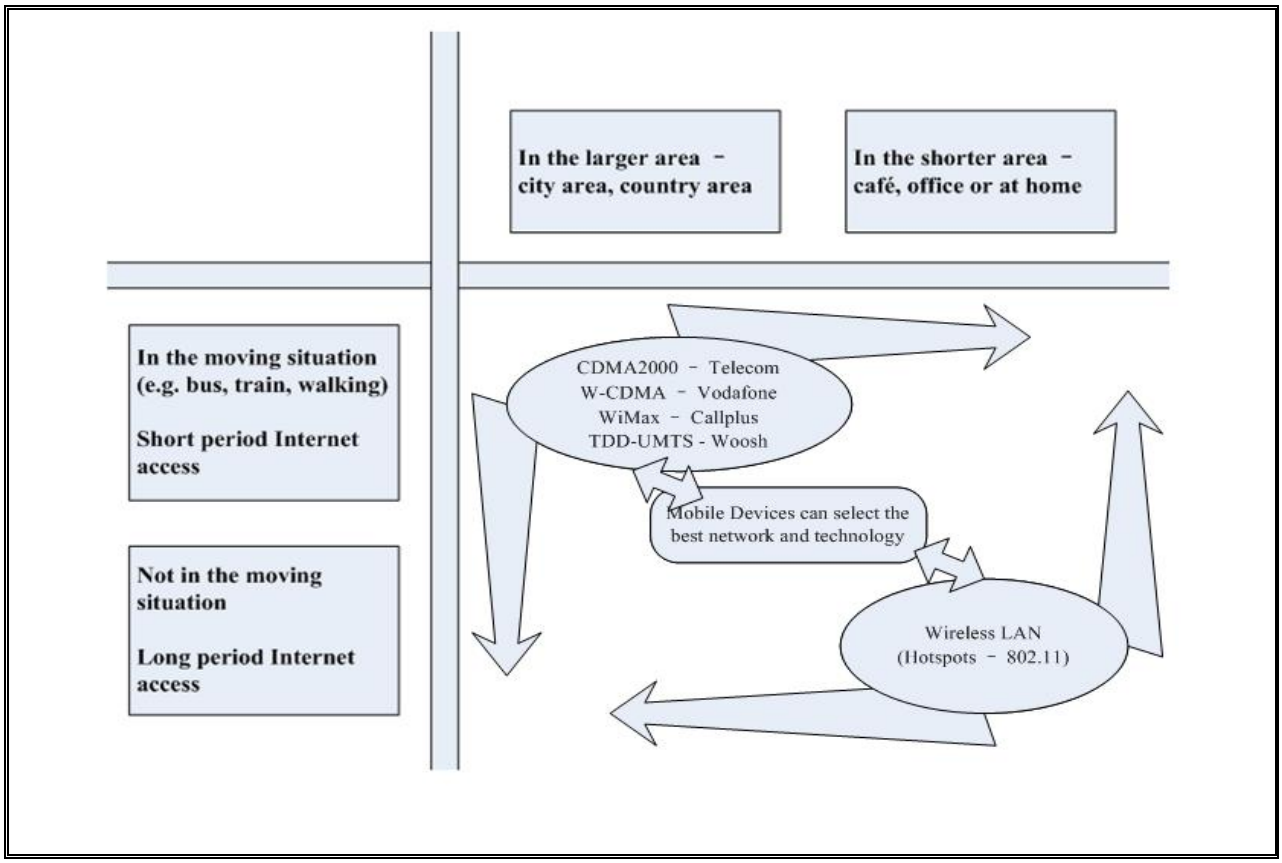


Figure 11: Mobile Internet Environment

In summary, the ABC mobile Internet environment benefits end users, this situation and environment may eventuate when network convergence matures. However, the ABC environment is a prospective model and it requires strong availability of mobile Internet services and mobile device capability.

7.1.3.4 Summary

To sum up, it is difficult to predict what kinds of applications will be available in the future. There are lots of services that do not exist at the moment, as network convergence matures, more and more end user services will become available when users wish to pay for and use them, mobile Internet is one example.

The findings of the research project are discussed and the answers to the three research questions are analyzed, based on mobile Internet deployment and its impact

on the New Zealand market. The research implications will be described in the next section.

7.2 Research Implications

This section describes the research implications of the research project. The major contributions of the project and its limitations are stated. As mentioned in Chapter 1 – Introduction, one of the major objectives of the research project was to outline the requirements of the most appropriate mobile Internet deployment model for New Zealand.

7.2.1 Research Contribution

Based on the descriptions in section 7.1, the requirements of a suitable mobile Internet deployment model for New Zealand is proposed in this section, and the proposed required features of the mobile Internet deployment model are considered as a major contribution of the research project. The findings and the analysis of the data collected from multiple sources (for example, market observation, literature review and interviews) made it possible to identify the requirements of the mobile Internet deployment model in New Zealand. According to the findings in section 6.7, the required features of the most appropriate mobile Internet deployment model can be classified into two areas: business and technological.

7.2.1.1 Business Characteristics

Firstly, according to section 7.1.1, in order to fit into the New Zealand market and reach customers' expectations, a mobile Internet deployment model will need to:

1) offer a service profitable to providers;
2) offer a service at a price that is affordable to customers;
3) offer a high standard of customer service;
4) offer as large a bandwidth as possible;
5) offer excellent and reliable quality of service;

6) offer a service that covers the whole country;
7) offer a deployment model that can educate customers;
8) offer a deployment model that contains a good promotion strategy.

The researcher classified the 8 statements above into 4 categories from the business perspective: *Price Driven* (1 and 2), *Customer Centric* (3, 7, and 8), *Quality of Service* (4 and 5) and *National Coverage* (6).

7.2.1.2 Technological Characteristics

Apart from that the business features, the deployment model will need to adopt a suitable technology or protocol in deploying mobile Internet services and goes in the direction of the convergence process mentioned in section 7.1.2.

Table 21: WiMax, WiFi and CDMAs in Deploying Mobile Internet Services in NZ

Technologies	Advantages	Disadvantages
CDMA / W-CDMA	Current leading technologies in the mobile market	Huge cost for updating Lower bandwidth than others
WiFi – Mesh Network	Faster and more stable	Everyone can enter the market Difficult to deploy services in large area (for example, national wide)
WiMax	Wide coverage and high speed Suitable for next generation network	Equipment is expensive Need to receive spectrum from government

According to the findings in section 6.5 and 6.7, in comparing the advantages and disadvantages of different technologies (CDMA/W-CDMA, WiFi and WiMax) presented in Table 21 above, WiMax is the best option for deploying mobile Internet service in New Zealand (whole country area deployment) because WiMax offers

wider coverage, higher bandwidth and better quality of service. WiMax is also Internet protocol based, suits the requirements of the next generation network; however, WiMax will not be well accepted and deployed until equipment becomes cheaper. In addition, service providers cannot offer WiMax services until they receive the spectrum from the government.

Therefore, most participants believed that WiMax is the most suitable technology for mobile Internet deployment in New Zealand; because the country has a large area and a small population. Some evidence was found in the literature that yielded the same result (Haagsma, Haylock & Sandrasegaran, 2005; Gunasekaran & Harmantzis, 2007; Abichar, Peng & Chang, 2006); WiMax is the most suitable solution for future mobile and Internet deployment.

7.2.1.3 Summary

According to section 7.2.1.1 and 7.2.1.2, the research builds a framework that outlines the required features (business and technological) of the most appropriate mobile Internet deployment model for New Zealand, see Table 22:

Table 22: Required Features of the Most Appropriate Mobile Internet Deployment Model

Specification	Description
Price Driven	The market and customers are both price driven in New Zealand, the cost of deployment should be affordable to the providers
Customer Centric	Customer acceptance and adoption are critical success factors for mobile Internet deployment in New Zealand
Quality of Service	Quality of service is a long term strategy for mobile Internet deployment in New Zealand
Nationwide Deployment	Mobile Internet services should be deployed over the whole country
Suitable Technology	WiMax is a suitable technology for deploying mobile Internet services in New Zealand

The competitive Internet market is price driven, and customers are price driven as well. The mobile Internet deployment model should be customer driven, because customer acceptance is the critical success factor of the deployment model and customer adoption brings business values to mobile Internet service providers. By meeting the required features described in Table 22, a mobile Internet deployment model should also follow the course of the convergence process. In the future Internet and mobile environment, mobile devices will adopt the single access protocol suite and access the single access platform (converged network); service providers should deploy extensive end user services, which maximize customer satisfaction and meet market demands.

To sum up, mobile Internet value chain players (network operators and Internet service providers) in New Zealand can prepare to accept the characteristics (business and technological) of the deployment model proposed above, in order to maintain a competitive business environment and obtain better business advantage. On the other hand, the proposed deployment model significantly benefits customers, as the Internet market and deployment model will become primarily customer driven. Finally, in terms of the technological perspective, both the participants and the previous literatures state that WiMax will be a suitable technology for deploying mobile Internet services, not only in New Zealand, but also anywhere in the world.

7.2.2 Research Limitations

Three research questions are equally important to the research project; however, during the actual research process, the answers from the participants relating to research Question 2 and research Question 3 were concerned with similar areas. In the initial research design process, the researcher intended to formulate only two research questions (1 and 3) but the researcher found that research Question 1 (deployment requirements) and research Question 3 (end user services) do not address the relationship between mobile Internet and the convergence process. That was the

motivation for formulating research Question 2, yet this research question may not be of interest to the participants, although mobile Internet is a key factor that influences the convergence process; it is not an element in the mobile value chain model. Therefore, the industry players as well as the consumers may not be interested in how mobile Internet contributes to the convergence process.

The researcher intended to find whether industry participants representing different business models (network operators and Internet service providers) had different opinions. However both business people offered similar views in answering the questions, they do not show any disagreements on mobile Internet deployment. During the interviews, the network operators believed the major (front line) competition was between the larger players and ISPs were only service resellers in the New Zealand market. In contrast, most of the minor players feel optimistic because mobile Internet provides both challenges and opportunities for them. Apart from that, the data gathered represented mostly the viewpoint of the senior management of the service suppliers; no market observations were made to confirm the perceptions gained from the respondents. Finally, the multi-case sample size is relatively small.

The New Zealand market is competitive, and business strategies change constantly. Mobile Internet will indeed have significant impact on business strategies for the telecommunication companies. Due to the length of the thesis process (12 months), some information gathered from the preliminary market observation changed while the research was ongoing. One such example was Telstra Clear's plan to build a 3G network with W-CDMA technologies in Tauranga (see section 3.3.1.2) in early 2007. However the company terminated the project in June 2007. Although the market, the business environment and technologies change all the time, mobile Internet deployments are really price driven and customer driven, thus the outcomes this research project are not influenced by the changes in the business environment.

The data and opinion collected from the interviews were primarily used to outline the requirements of the most suitable mobile Internet deployment model for New Zealand. The research project does not have any evidence as to whether the research results can be applied in other countries or different markets. Further investigation could continue that work, and cross-country research may be useful in finding the answers.

7.3 Conclusion and Recommendations

The analysis and discussion summarizes the main ideas from the Case Review – Chapter 5 and the Case Findings – Chapter 6 in order to answer the three research questions. Based on the answers to the research questions, the researcher proposed the most appropriate mobile Internet deployment model, which is considered a main contribution of the research project. Further investigation can be conducted to find out whether the proposed deployment model can be adopted in other countries and market structures.

Chapter 8: Conclusion

This thesis systematically examines mobile Internet deployment and its impact on the New Zealand market. The research project set its goal as an investigation of a mobile Internet deployment model and its impact on New Zealand; the researcher reached the goal through completing the research objectives defined earlier:

1) the telecommunication sector and Internet competition are described;
2) the trend of adoption from fixed line to mobile Internet is investigated;
3) some future issues such as network convergence, future mobile devices and end user services are described and discussed;
4) the requirements of a mobile Internet deployment model are outlined;
5) and the specifications of the most appropriate mobile Internet deployment model are identified.

Three research questions concerned with mobile Internet were formulated based on the preliminary literature review and market observation, and the researcher used interview to collect research data from the respondents. The researcher tried to find the answers to the research questions from participants' opinions (business views and personal insights) of the research area. Moreover, the researcher used both a 'vertical' and 'horizontal' approach in reviewing the raw data, and finally applied spiral and comparative approaches in the analysis and discussion sections. The most important contributions of this thesis are the outlining of the requirements of mobile Internet deployment in New Zealand and the identification of the specifications of the most suitable mobile Internet deployment model.

Mobile Internet indeed poses a huge impact on the Internet and mobile development. Mobile Internet is a service presently available from both the stationary Internet and the mobile network. Mobile Internet is also seen as the driver that will push the network convergence process. Extensive end user services become available over the

converged network, and mobile Internet certainly is a contributing factors in future Internet development and the mobile evolution process.

In terms of mobile Internet deployment in New Zealand, the customer is the most important critical success factor to the deployment model. Mobile Internet services are customers driven and focused and so the service deployed should meet customers' expectations, as customers' acceptance and adoption will lead to successful deployment and bring business value to mobile Internet service providers.

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Appendixes:

Appendix I: Case Description

	Date & Time	Business Type	Position	Comment
Interview 1	March 9, 2007 10:00-10:40	Internet Service Provider	General Manager Information Systems	One further email contact
Interview 2	March 9, 2007 13:00-14:00	Network Operator	Client Activation Network Inventory Specialist	One further face-to-face contact
Interview 3	March 16, 2007 9:30-10:00	Internet Service Provider	Wireless Solution Manager	One further email contact
Interview 4	March 23, 2007 15:15-13:45	Network Operator	Marketing Manager – Wireless Office	No further contact
Interview 5	March 22, 2007 10:30-11:00	Internet Service Provider	Technical Specialist	No further contact

Appendix II: Interview Transcription

Interview One:

1. **Could you please explain the role of your company in the telecommunication and Internet market? For instance, network operator, Internet service provider or virtual service provider.**

In general, question one is concerned with the introduction of the business and the related services. All answers to interview question 1 are introducing the interviewees, companies and the Internet services, thus this information will not be presented in this section, and perhaps the researcher will use some of the information in other sections of the study.

2. **Could you please briefly describe the telecommunication and Internet market mix in New Zealand? (for example, Competitors, partners, major / minor players in telecommunication and Internet market)**

New Zealand's broadband is primarily with DSL, there are companies like Telstra Clear who has small urban areas of covering with the infrastructures in the ground primarily fiber. But the biggest DSL proportion in New Zealand is covered by Telecom with its copper wires in the ground. New sub-divisions being built may be different at this stage; the sub-division maybe economically put fiber in the ground whereas an existing ac-hoc you are going to build and you are going to take up to the ground, potentially resource consent, LAN, fiber, we already have copper, it is quite often not financially feasible.

So the majority New Zealanders served by Telecom's DSL and the copper wires, the majority of sales broadband in New Zealand is Telecom and some small ISPs are reselling Telecom's Internet services. Participant 1 is one of the companies not doing that.

3. **Do you think that the Internet competition has moved from fixed-lined Internet to mobile / wireless Internet? Could you explain further to your answer**

I will say: not yet. Wireless and mobile broadband is absolutely the way of future, it is the exactly the same step from the landline in your house to mobile phones, and it is a long process. To the point now a lot of people say that, I must have my mobile phone, actually I can do it with my landline phone. We still probably on between 1/3 to the half way along that path from fixed-line broadband which will always be faster than the mobile and wireless broadband, which is a lot more friendly and usable when you do lots of swapping works. The speeds of the fixed-line and wireless both going up, as long as the wireless broadband is fast enough to do the job you want to do, then it will become a better option to the fix-line broadband all the time, but we are not there yet. We are on the path towards to it

4. **Does your company offer or plan to offer mobile Internet services? If the answer is yes, could you please briefly describe the service and deployment?**

In general, question one is concerned with the description of the mobile and wireless broadband deployment and services. The answers to this question may allow the audiences to guess the participants, thus some information will not be presented in this section, and perhaps the researcher will use some of the information in other sections of the study.

5. **In your opinion, what specific requirements does a mobile Internet deployment model need to meet in order to fit in the New Zealand market and competition?**

New Zealand market is quite different from Australian market, and that is really price driven. No matter what you offer, you have to have good price. So for example the Vodafone offering, a very successful device that works in a lot of places because it works on the Vodafone network in a wide coverage, but it is never really going to be well taken up because it works on the telephone network and it is very expensive.

Back to your question, in general, lots of bandwidth if mobile broadband intends compete with DSL and fiber, DSL and fiber will always have larger pipes and higher speed. But as long as your wireless pipe is big enough and faster enough for people to do the thing, people would like to use wireless and mobile broadband because mobility is the 'plus'. In New Zealand, it is actually quite hard to roll up a mobile network, the resource management act requires that you notify every cell site that you build, it is a process to go through, it is actually quite hard to spend a lot of efforts, time and money to build up a national wireless network in New Zealand. So that is a barrier to the new player coming in.

6. **Some technologies (for example, CDMA networks, WiFi and WiMax) are available to deploy mobile Internet services presently; could you please give me some personal ideas about – the strengths and weaknesses of each deployment model?**

I can talk half an hour for this question only.

The CDMA networks have low capacity, so the sort of applications and the sort of people use Internet may never really go into or be the drivers in the market. There are revisions coming along with the CDMA networks and some improvements are set on the CDMA networks. But they are behind the technology that Participant 1 has at the moment. So, why would you use a new version of CDMA space that is not the best and there is a large amount of expense to upgrade the CDMA network than step up

with other methods. Too many works, thus I don't think CDMA is the best solution in the future.

WiFi is great for what is does, so around a house what WiFi offers the advantages that everyone can use it, so it gives you the feeling of mobility and you are not stacked by a wall. In fact we sell quite a lot of the wireless modems and they need to be plugged into the wall, and then they are working with a WiFi attached because they would like to have this version, not only wirelessly connect to the house, but anywhere in the house. WiFi will never be usable in kind of city type space since it does not really handle that. If you want to cover the whole city, it should have lots of cell sites work, like the WiFi access points, to get the reasonable coverage, but it will cause coverage overlap, so in my point of view, WiFi is god for café, good for home, good for the bus station, it has got quite a lot applications, but it is not the general solution.

WiMax is something that participant 1 spends a lot time thinking about, however it is quite far away this technology is alive on deployment today. The WiMax specification says that the WiMax will never ever deliver what you expect; there is a curve of debug we call out as equipment becomes faster and cheaper, as people understand the issues better, as optimization techniques to help different cell sites to deal with each kinds of check out, so WiMax will not be used in at least a couple of years. "Intel" says that the chips they built for mobile devices like laptop will support WiMax in 2008. That is quite a disadvantage that while we sell to the customers, we should sell them a modem which is expensive to us, and we cannot charge the customer all that value because New Zealand market is a price driven market. At this stage, it is much friendlier to have the WiMax enabled laptop available and we only sell the WiMax services to the customers, it is much better in the economic point of view. WiMax is a coming way and end up being better than current technologies in a couple of years, but sometimes we may decide make the shift with WiMax to the market.

Do you get restriction from the government about WiMax deployment?

Yes, there we do. To do any mobile network, you need lots money, you need to build cell sites, and you need to get the radio spectrum, and you have to buy the spectrum from the government. And the government has been changed the rules constantly about thinking reallocate the spectrum. So there are the processes that the government put into the place goes through to decide who gets to use the spectrum and participant 1 is very much involved to the consideration. In fact, because you are going to spend a huge amount of money to build the WiMax networks, and you are only earning for example $20 per customer per month, it seems that there is a long term development for adopting WiMax. In case you own the spectrum for 10 years, you should spend 2-3 years to build the network, and you have 7-8 years running the network. We have a good spectrum at this moment and we hoping the government process will leave us a good situation with prospective spectrum, but we don't know yet at this moment.

Due to my research, some New Zealand companies such as Call plus starts offering WiMax services and intends to build the national WiMax network, because they start deploying WiMax services, will you use the same technology to compete with them?

Absolutely, as we are using the same technology, they will have exactly the same issues such as cost that we have. You have to build the cell sites, and it takes a lot of money and a lot of time, WiMax network is a radio network, there are lots of optimizations you are experienced to build up over the time. So put it in this way, it we want to swap to WiMax, and then it will be much easier and faster doing that for us than a new company to implement the infrastructure, because what we have to do is putting different equipments on the cell sites.

7. Do you think mobile Internet will contribute to the convergence of networks (for example, stationary Internet and the mobile network), technologies (CDMA, WiFi and WiMax) and services? And how?

Absolutely, I am not a great person to predict the future, one of the things that stick in my mind is that the people who make mobile phones, there are different standards of mobile phone to work of, for example in New Zealand, there are Telecom standard and Vodafone standard. People who make mobile phones, they have the devices got lots of different bands, when you actually look at the portion of that, it is different between the phones work in the Telecom network and Vodafone network, the different is quite small such as the radio frequency. So people make phones and they hate putting different chips and ports with different standards, in different countries and with different radio frequencies. It might be the same technology, but each country might use the mobile phone with different radio frequency, so you need different chips. People try to standardize 95% of the mobile phone and just hide the difference per Telco in 5%. That is sensible. What they are now starting to do is having one chip with different frequencies for particular Telco, and it actually has two slots, and these mobile phones will start appearing to the market now, so in few years time, you might have a mobile phone, that could run against both Telecom network and Vodafone network.

Why we do that?
Maybe in certain area, Telecom works but Vodafone does not, so the mobile phone itself could detect who has got the stronger signal and use the one with stronger signal. Maybe this phone smart enough to know that in the central Auckland, this Telco is cheaper, and in this part of the country this Telco is cheaper, so the phone could select the Telco depends on what is the cost. So you start thinking of that, to the user, they only want thinks work and work cheaper, these things take advantages to them. Think of that kind of model, and then I think that overtime; the devices will end up with two or three different methods or technologies. For example, a laptop with Intel chip,

WiMax will be available to the chip soon; most chips come with WiFi now, and all laptops have a DSL network port at the back, in addition, Bluetooth perhaps. There are four methods that the laptop could be connected.

At the end of the day, the person sitting down does not care as long as they could browse the Internet, it always work no matter what services and technologies are used. The convergence is happening now and it would continue happen, more devices would have more smart about how to connect different networks and work seamlessly.

8. Could you please describe how will mobile Internet deliver end user services based on the converged networks and technologies? (for example, cross network, multi-technologies)

In general, the answer of this question is quite similar to the previous one, and it is hard to see what the applications are going to be in the future. We will think about mobile wireless offering the data pipe, it is a neutral data pipe down which whatever the users want to do, and next it is fast enough to support the applications. There are a lot of applications which are mobile specific, for example, the lookout mobile phone will start employing things such as GPS chips, and in some countries this service is available now. If the mobile phone knows where you are, the services could request for the closest fish and chips shop, the closest band and the closest toilet. There are lots of services don't exist now, will exist in the near future until someone wish to pay for them, who knows.

9. What would be the most appropriate mobile Internet deployment model or solution to New Zealand market based on your personal ideas and experiences?

As we are on 1/3 from the path between fixed-line Internet and mobile Internet, we are not pushing the mobility site as much as about the price site, but as our coverage grows, we will push our mobility site. So the deployment model changes over the time, as the technology is improved, the coverage is improved, and the price goes down.

Deployment model, just get broadband in a hand of as many New Zealanders as we can, any method we can, and educate people what we can do for them. My parents are 60-65 years old, they start using computers in the last 10 years the Internet in the last 5 years, they think that is great, because the new deployments educate them how to use the technologies.

10. You mentioned that: “A prospective deployment should educate people.” This was quite an interesting point to my study, could you give me a further explanation (might be an example) of how the deployment could educate people?

In order to get prospective customers to move from Dialup to Broadband, we need to demonstrate the advantages of broadband to them. If the prospect does not know much about the Internet then this "demonstrate the advantages" might actually mean "educating the prospect as to what can be done on the Internet". For example, a sales drive based around giving free community based introductions to computers and the Internet.

Interview Two:

1. **Could you please explain the role of your company in the telecommunication and Internet market? For instance, network operator, Internet service provider or virtual service provider.**

In general, question one is concerned with the introduction of the business and the related services. All answers to interview question 1 are introducing the interviewees, companies and the Internet services, thus this information will not be presented in this section, and perhaps the researcher will use some of the information in other sections of the study.

2. **Could you please briefly describe the telecommunication and Internet market mix in New Zealand? (for example, Competitors, partners, major / minor players in telecommunication and Internet market)**

Well, basically New Zealand has four major telecommunication providers, and they could be known as the main network operators, which are Telecom New Zealand, Vodafone, Telstra Clear and Vector, since this energy provider owns some fiber networks as well. Participant 2's main competitors are Vodafone and Telecom; we don't concern the small companies as our competitor, such as the ISPs who resell the services from the network operators. In some areas, Participant 2 is essentially working co-relative with Telecom and Vodafone because no one is available to provide services that cover the whole country. For example, Telecom is the major competitor of Participant 2; however Participant 2 is the largest client of Telecom.

Do you think that the competition in the telecommunication and Internet market is held between the four major network operators that you mentioned?

Not really, different companies have different roles in the industrial area, for example, the network operators (for example, Vodafone, Telecom and Telstra) are competing with each other at a higher level, and the smaller ISPs (for example, iHug, slingshot and Xtra) are competing with other ISPs at a lower level, and the small ISPs do rely on the larger network operators to provide the infrastructure and technology, otherwise they cannot reach the customers. Therefore the ISPs in New Zealand are like the service whole sellers, they primarily focus on customer services, not too much about technology. Unlike some ISPs, Woosh is a different case because they provide wireless services; they can beyond the traditional network infrastructure, they can directly connect to the customers. But what is happened to Woosh, because although they can reach the customers, they could only offer Woosh services to customers in the particular areas, and sometimes they cannot work independently without getting support from the main network operators. Thus they are expanding their network at this moment.

3. **Do you think that the Internet competition has moved from fixed-lined Internet to mobile / wireless Internet? Could you explain further to your answer**

Talking about wireless or mobile, I think it is a trend here, because we are talking the telecommunication industry is in the transformation period, so we are transforming from the traditional telecommunication companies to the future telecommunication companies. In the traditional environment, we have our large infrastructures such as cable, fiber or any types of physical media connected. But once the mobile technology is well developed recently, everything will be mobilized people who want to move from one physical location to another, and this is the power of mobility.

So you mean the trend is presently happening and will continue happening.

Absolutely, and it will be changed quickly. The mobile competition indeed impacts the business strategies of the telecommunication companies. Like Participant 2, we are now looking at the mobile market as well; Participant 2 is now having a project which is dealing with mobile and wireless services.

4. **Does your company offer or plan to offer mobile Internet services? If the answer is yes, could you please briefly describe the service and deployment?**

In general, question one is concerned with the description of the mobile and wireless broadband deployment and services. The answers to this question may allow the audiences to guess the participants, thus some information will not be presented in this section, and perhaps the researcher will use some of the information in other sections of the study.

5. **In your opinion, what specific requirements does a mobile Internet deployment model need to meet in order to fit in the New Zealand market and competition?**

The most important requirement is the speed, the bandwidth, and the services provide to the customers. For example, voice over IP, TV over IP, even the credit card services over the mobile devices. The requirement will be how we develop a technology or how we deploy the technology which will meet the customers' desire. It is all around the customers, particularly if the customers are looking for a high speed wireless connection with multi-services, we have to work on it, and deploy the mobile and wireless services that suit for the customers.

Do you think that mobility is also an important factor to the customers?

Definitely, the industrial sector has been changed a lot as well as the human behaviors. In the old days, we have fix-line internet, and nowadays people want to have mobility because they can work in the coffee shop for instance, or anywhere is the earth they could have Internet access via the mobile devices. Some technologies such as VPN, wireless and mobile Internet connections make this come true. Because of the mobility, they can continue working in a different location or a more relax environment, they can communication better and with a more efficient communication method.

6. **Some technologies (for example, CDMA networks, WiFi and WiMax) are available to deploy mobile Internet services presently; could you please give me some personal ideas about – the strengths and weaknesses of each deployment model?**

We have talked about WCDMA and CDMA2000, in my opinion, Telecom is using CDMA2000 and they do have some limitations or disadvantages on their existing infrastructure to offer the real 3G technologies and services. The way of building the CDMA network and deploy 3G services are based on the existing traditional telecommunication infrastructure. For example, between the 'Trunk' – customer distribution center to the main distribution center, they use copper for the connection, this quite often negatively effect their services.

WiFi or the hotspots, the IP-based network, you have got the access points, putting anywhere like inside the building, public areas such as cafés. But WiFi only gives you smaller or limited service ranges, normally WiFi can only reach the range for 100 meters. Therefore, WiFi is suitable for local wireless access; it is not a good solution to deploy services in a larger space, such as national range, even a city range.

WiMax is the 4G, the next generation technology. We don't have too much details on how well the WiMax technology and its services are, and what they look like, we also don't know what products can be wondered, because WiMax equipments are nowadays produced by some particular providers such as Nokia and Intel. WiMax equipment is really expensive and it is not cost effective to deploy WiMax services in New Zealand unless the cost of the equipments goes down. Telstra Clear is not thinking about WiMax at this time, but I personal agree that WiMax is a long term solution for wireless and mobile technologies.

Do you think that WiMax will take the place of CDMA in the Future in New Zealand?

I read an article; it says that WiMax will be taking in place after 2010, the development of WiMax nowadays is not mature enough compares with WiFi and CDMA, and as WiMax comes from the IP background, it does not come from the traditional telecommunication background. While WiMax will be adopted in the

future by the telecommunication companies, the old infrastructure will be changed, as well as the provided services. For example, voice over IP, your telephone calls will be the IP packets over the large network rather than presenting your calls on the sockets based connections. Perhaps, WiMax is a technology that primarily contributes to the NGN, the next generation network because everything in the network contains an IP, but we don't know yet, that is only a guess. The telecommunication industry is in the transforming period, we cannot presume that what is going to be like in the future, we can see trend where the fix-line moves to the warless and mobile for Internet deployment, and then we are talking about the socket-based network and the packet-based network. It is a trend to move to, we can predict when it will happen, but pretty sure it will happen in the next 20 years. In my view, the old infrastructures are not easily removed or disappeared, so WiMax, WiFi and CDMA will appear in the same ear, possibly competing with each other. For example, movie and television, movie is older technology and television is newer, they are showing the similar things to customers in a larger and smaller screen, but movie will never die. When Internet television is available, traditional television is still there. There is a long process to remove one ole thing such as WiFi or CDMA, they have their providers and customers, as well as the market, and they will be totally disappeared until they are valued at'0'.

The old network dies, it will be transformed to different kinds of network with newer technology, it is easier to upgrade a network than re-build a network, and maybe a small amount of people will still use the old technology.

7. **Do you think mobile Internet will contribute to the convergence of networks (for example, stationary Internet and the mobile network), technologies (CDMA, WiFi and WiMax) and services? And how?**

As you say, the mobile technology, the mobile Internet will significant bring an impact on the current technologies. Thinking about this, the convergence between technologies would be like Internet combines with telephones, you have got the VoIP; you combine TV with Internet, you have got the TVoIP. When you are talking about mobile, it would become Mobile over IP, with the mobile added on, there will be something like mobile voice over IP or mobile TV over IP. The end users services, for example, mobile banking, credit card on mobile and so on.

Mobile Internet will significantly bring the push and boost to the convergence of the networks, services and technologies.

8. **Could you please describe how will mobile Internet deliver end user services based on the converged networks and technologies? (for example, cross network, multi-technologies)**

Right now, most of the companies have got the experiences to design and deliver end user services while the convergence becomes mature. There is a quite successful mobile service in Japan nowadays; a mobile could be used as the credit card, or a mobile phone is combined with credit card services. If you go to the supermarket, instead of having your credit card, you can pay your bills on your mobile phone. What you need to do is when you reach to the counter, a txt message that contains to payment details is sent to you, if could accept the payment by pressing the key or refuse to accept the payment, and the money will be automatically transferred from your bank account or bank account.

The converged networks and technologies, the mobile Internet might deliver end users services mostly depend on two reasons: as long as the services become available and the customers like the services. We are talking about the Internet services, for instance on a mobile phone, once people converge the Internet with mobile technologies, and the Internet become a main feature of the mobile phone, and the mobile is the mobile device to allow the customers having Internet access anywhere.

9. What would be the most appropriate mobile Internet deployment model or solution to New Zealand market based on your personal ideas and experiences?

WiMax is a perfect example for deploying the mobile Internet in New Zealand, because it is designed for metropolitan networks with faster speed and wider range than any current technologies. The WiMax can support approximate 60 kilometers range, thus it is a cost-effective way to build a national WiMax network, as the distance between one cell-site to another is large. It is suitable to New Zealand market because New Zealand has large city area with small population.

If WiMax is a good solution to the country, do you think a pure WiMax model is more suitable or a network contains WiMax or other technologies, such as CDMA and WiFi?

As I say, the old technology will not be disappeared in a short period of time; perhaps 3G and 4G technologies are running in the same network in the near future, because some customers are still using the old technologies to connect to the network that is based on 4G mobile technologies, the 4G network becomes the backbone, and customers might use 3G technology to connect to the backbone. No matter what technologies, new or old are working in the network; the most important consideration is how to work faster and easier. While we are talking about the best solution, we should think about the affordability to both customers and services providers. For example, you cannot sell $20,000 equipment to a customer because no one wishes to use that; also a service provider could not spend billions of dollars to build a network for 1 million customers. The way we have to take care of the

customers make sure all the equipments, technologies and services provided in a proper pricing rate.

Do you think New Zealand market is a price driven market? Do you think that customers do not really care what technologies you use, and they care how much the services cost more than any other features?

I would like to say anywhere in the world are the same, price is attracting people, right, I give you an example, if you drop your price down, you can attract more customers or more customers would like to use your services, but you cannot keep them. When we are talking about a business, you don't want your business only getting more customers with your price going down and you cannot keep the customers. Even you offer a lower price, but lacking of good customer services for instance, you will achieve a good business. We have to make sure all the customers are taken care in a professional manner, and we can provide very efficient, professional and costless services. I mean price is the only thing in the business sense, it is more important to keep your customers using your services for the long term view. But you have to understand that the customers will compare the offered prices, as well as comparing other features such as the customers' services, service efficiencies and so on.

Interview Three:

1 · Could you please explain the role of your company in the telecommunication and Internet market? For instance, network operator, Internet service provider or virtual service provider.

In general, question one is concerned with the introduction of the business and the related services. All answers to interview question 1 are introducing the interviewees, companies and the Internet services, thus this information will not be presented in this section, and perhaps the researcher will use some of the information in other sections of the study.

2 · Could you please briefly describe the telecommunication and Internet market mix in New Zealand? (for example, Competitors, partners, major / minor players in telecommunication and Internet market)

Telecom is the PSTN provider, so basically all ADSL service has to be on the telecom network. Also CDMA network is provided by telecom.

Vodafone is the GSM network provider.

Telstra has its own fiber optic network in certain areas such as Wellington and Christchurch.

ISPs are providing different services, say ADSL, wireless, mobile and so on, so they have to rent / cooperate with the Network provider.

Basically, service providers and network providers are different parties. As now other ISPs have a chance to put in their DSLAM machine into our exchanges, so they can provide their own DSL service. But of course, they still have to use our network currently

3 · Do you think that the Internet competition has moved from fixed-lined Internet to mobile / wireless Internet? Could you explain further to your answer

Yes. Compare the prices of wireless broadband with last 3 years, it is constantly dropping. It is a trend that wireless Internet is getting the market. But of course, fixed line service would not disappear until far future due to its stability and performance.

4 · Does your company offer or plan to offer mobile Internet services? If the answer is yes, could you please briefly describe the service and deployment?

In general, question one is concerned with the description of the mobile and wireless broadband deployment and services. The answers to this question may allow the

audiences to guess the participants, thus some information will not be presented in this section, and perhaps the researcher will use some of the information in other sections of the study.

5 · In your opinion, what specific requirements does a mobile Internet deployment model need to meet in order to fit in the New Zealand market and competition?

Nothing really matters. Customers would not care about the technology aspects. As long as the wireless access could do what fixed line can do at the same price level, wireless can get the market.

6 · Some technologies (for example, CDMA networks, WiFi and WiMax) are available to deploy mobile Internet services presently; could you please give me some personal ideas about – the strengths and weaknesses of each deployment model?

CDMA has a wide coverage in NZ, but only in NZ, so may not be able to roam to other country. WiFi and WiMax are new worldwide standards, but they are still not quite common on mobile devices (for example, cell phone).

7 · Do you think mobile Internet will contribute to the convergence of networks (for example, stationary Internet and the mobile network), technologies (CDMA, WiFi and WiMax) and services? And how?

A hybrid solution may emerge, say support wireless and wired at the same time, just like a computer can have LAN port and Wireless port. A more extreme end would be an auto sensing device which could choose the best network according to the environment.

8 · Could you please describe how will mobile Internet deliver end user services based on the converged networks and technologies? (for example, cross network, multi-technologies)

Refer to above answer. A cell phone which supports GSM and CDMA, WiFi or even GPS service may exist very shortly.

People would use a cell phone just like using a computer, and for the Internet services as well, people will think that, ok, I can do this with my cell phone, I can do that with my cell phone, that drives that a cell phone is not only used for making phone calls and sending messages anywhere, but having Internet access and services anywhere.

9 · What would be the most appropriate mobile Internet deployment model or solution to New Zealand market based on your personal ideas and experiences?

Currently not available. A hybrid model may be needed to cope with different situations. However, as stated previously, price is very important.

Interview Four:

1 · Could you please explain the role of your company in the telecommunication and Internet market? For instance, network operator, Internet service provider or virtual service provider.

In general, question one is concerned with the introduction of the business and the related services. All answers to interview question 1 are introducing the interviewees, companies and the Internet services, thus this information will not be presented in this section, and perhaps the researcher will use some of the information in other sections of the study.

2 · Could you please briefly describe the telecommunication and Internet market mix in New Zealand? (for example, Competitors, partners, major / minor players in telecommunication and Internet market)

Yes, so I guess the Internet market concerned is probably three main players: Telstra Clear, Vodafone and Telecom. En, and I say Participant 4 now because an ISP and our co-relationship, because we were not in the top three for Internet. And apart from that, you have got the next level of Telco, then you have for the Call Plus, Slingshot, Orcon and those kind of providers, that typically resell the services solutions provided by the big players, a little bit of the own kind of the networks in the middle. And you have the specialists; those kinds of providers will provide very emerging type of solutions. But you look at it is the good percentage to businesses would be those top three. But that is changing, New Zealand has an opened market, opportunities are always happening to those levels 2 and level 3 telecoms companies to provide more services and their own services, more control on the services that they provide.

So do you mean the market is changing?

Yes, I think the market is becoming more competitive, and especially it would become more competitive when you get things like local loop unbundling. We have done a little bit with wireless broadband with participant 4, and currently got almost the same number of end users as the whole broadband sold through Telecom. So we have got a very good penetration for broadband usage, is a completely and separately alternative to Telecom.

3 · Do you think that the Internet competition has moved from fixed-lined Internet to mobile / wireless Internet? Could you explain further to your answer

I think the competition, more in the fix-line, but that mostly from the service perspective rather than the functionality or a price, because the price is all controlled by Telecom. En, but form the service prospective, there is a lot of competitions and the bundling going on, with the services that try to be more attractive, to those

customers to change the way from Telecom. There is not a serious competition in the fix-line that I guess from the point of view to consumers, because the price is not going to change too much. But in wireless, I think, the only real competition is Vodafone and Telecom really; although there are some I can see the ISPs and other service providers with different services. Good national penetration, and services availability is probably Vodafone, Telecom and Woosh.

Do you think that the market in New Zealand is a price driven market?

En, I think the consumers are price driven, always, will be everywhere, en, I think there is definitely a perceived primarily around the wireless and broadband, but that might not be very long.

4 · Does your company offer or plan to offer mobile Internet services? If the answer is yes, could you please briefly describe the service and deployment?

In general, question one is concerned with the description of the mobile and wireless broadband deployment and services. The answers to this question may allow the audiences to guess the participants, thus some information will not be presented in this section, and perhaps the researcher will use some of the information in other sections of the study.

5 · In your opinion, what specific requirements does a mobile Internet deployment model need to meet in order to fit in the New Zealand market and competition?

En, I think, the performance is a key thing, the mobile Internet deployment has to keep alive and gain experiences from fix-line broadband, and as far as speed is concerned, reliability of the coverage and reliability of the services, those are very important. En, I think price is important, and it will become more important, as we get things like local loop unbundling, such as broadband, fix-broadband, the speed will be increasing and price will be decreasing, so wireless has to be now to keep out with that. Although the most people that practical use the service, there isn't at the moment in a big need in the applications space to have more than what we currently offer, I mean if you look at the services that you use on the Internet, can I watch video? Can I play games? Can I write email? Those kinds of things. You don't need gigabytes of speed to run that kind of stuff. If you move to the Internet-based TV, or that kind of services, the requirements will become bigger. So right now, I don't think it is enough, in that kind of consumers' applications space to warrant having much bigger performance that we have got, just having the marketing point of view.

6 · Some technologies (for example, CDMA networks, WiFi and WiMax) are available to deploy mobile Internet services presently; could you please give me some personal ideas about – the strengths and weaknesses of each deployment model?

En, I think, en as far as WiFi is concerned, there is a inter-portability should be concerned, a lot of devices are understanding WiFi. Weaknesses, from the Telco's perspectives, anyone can deploy WiFi, it is not a high cost area to enter the market, there are very specific services offering around WiFi, and network management offering around WiFi, that could be probably changed, but and the other thing is you have got typical lower sole radius per cell site for WiFi as well, so you'd better have lots of hotspots to get a good area coverage. And in a mobile environment, there is not a transaction between cells to base stations for not a fix location, while I am doing my download or what ever running an application and I want to move, I have to break that section and get a new connection in a WiFi environment.

For CDAM, I think the main disadvantage for CDAM is no one really in globally; there is not a big focus for people to develop applications and services in handsets. En, I don't see a very good future for it, although they do have some advantages, they have the ability to deploy less number of base-station to get a greater coverage, it is a little way of air interface work.

WiMax is good, but it does not, again it has the same kind of limitations right now as you have for WiFi, although you have got a broader reach, and it is a big advantage in cost to deploy is low, it really as long as deploy one service such as Internet access, for instance you have got a base station, but you could only deliver one thing, where you put the CDMA or UMTS base station, you can now deliver multiple services, so WiMax probably will become a challenge, I think because of the cost to deploy, because of range and the coverage you could get from the single tower, it is going to be in the Internet space, and the medium term in the mobile space that competes with CDMA and UMTS.

Do you think that Vodafone will consider WiMax?

I can say that we are talking with people, who deploy WiMax services and solutions and LTE (long term evolution) networks.

7 · Do you think mobile Internet will contribute to the convergence of networks (for example, stationary Internet and the mobile network), technologies (CDMA, WiFi and WiMax) and services? And how?

Mobile Internet will drive it, not contribute that absolutely. Once people realize that are not able to have some services, such as Internet access in some locations, mobility will fix in the long term. For most consumers and, I cannot see, en, from a practicality

point of view, especially for a new entry, everyone will want to put copper in ground, because that does not make sense, the cost to deploy is too high. Compare with mobile, the feasibility of the services is so low. For us, to go out and put a fix-line will pay a placement for someone to live in our side bundle the Internet on the same box, on the same day is millions time cheaper than put the copper lines on the ground. And then you are getting another benefit from mobility, like if you want to change your house today, my fix-broadband have to call someone, tell them I am moving, get them prepare a new connection or new site, pay them to do that, ask them to install the modem, wait for two weeks time, make sure work, all that kind of things. Mobility, I can just pick up my units, move to the new place, plug them in then I can work as normal. I can take my units everywhere; go to the beach, somewhere I want.

Due to my research, participant 4 does not have underground infrastructure, so the Vodafone connections are all wireless, is that right?

No really, between our core networks, we have the infrastructure. They are ATM and MPLS network.

Are you cooperating with other organizations outside your core network?

We have a number of different providers out there, Vector, Telecom, Telstra Clear are all providing the services to out connect our cell sites. We always find the best way to get external help.

8 · Could you please describe how will mobile Internet deliver end user services based on the converged networks and technologies? (for example, cross network, multi-technologies)

Yes, we are looking at things, on of the big things is the fix and mobile convergence, you can have the same experiences on your mobile Internet as that you have on your fix Internet, you can share the same bundle of usage between both ‘fix’ and ‘mobile’ Internet, that we can deploy a device on your premises that act as like a sole tower for example, and you can have all you phones in house talking through that fix-broadband assess point but using your UMTS to talk to as the last mode. We have a number of issues about converging, things like voice client, messaging client with the mobile network, and deliver it over our Internet broadband services.

Do you think that in the future, everything, no matter on the mobile network or Internet will be IP-based?

It would be IP, it would be other things, could be purely layer 2, for example. More it will be like in the short term in IP, Vodafone involved in its network architecture to IMS standard, which allows higher inter-portability between IP and fix network or mobile network. You know, it is separating the mobile applications from the mobile

signal, so in two separate layers, so you have got a core network to deliver the access, for about the fix access point to the wireless access point, and we are talking about, you have got a range of signaling and service control boxes, and then plug into a range of applications on top. That means we can talk to an IP sub-switch and we can talk to IP PBA-switch, we can talk to another courier, we can talk to our customers with IP, and that is directly interacting with the mobile network.

Participant 4 is currently supplying TV via mobile phone; do you think the network can handle this service, with a good performance and customer feedback?

We have a good uptake, we target we have set is double now, so both of us and the customers are quite happy with the performance so far. You know anything with wireless is coverage dependent, there are new standards coming out for wireless, TV; they are going to improve the availability of the service, the solution of the content, and reliability of it.

Do you think the bandwidth is large enough the supply those kind of services?

You mean the core network? Definitely, if you are looking at the standard TV in the bandwidth involved supply method is very low, for us TV is a stream media, so it is really just the content change for us, but not a technology change.

9 · What would be the most appropriate mobile Internet deployment model or solution to New Zealand market based on your personal ideas and experiences?

The current networks, so we have WiMax, CDMA, UMTS, within 10 years, will involve becoming a single access platform, so like you will not a big difference between providers to the access network, so anyone's device would be connected to anyone's network. You know things like IP connectivity to laptops or the devices in the house, that wireless broadband, fix broadband, that will all talk in the similar signaling protocol, probably cell port, something like that. So the access layer differences that we have now between CDMA, UMTS and WiMax and WiFi, those will be disappeared, and will be single access protocol suite running on the future network that everyone can talk to, the differences will be in the services you could provide over it.

If what you mentioned will happen in the future, how would protocols, such as CDAM, WiFi or WiMax, be disappeared?

That is already happening. For example, the UMTS goes to the next generation wireless technology, which is close to WiMax. WiMax standards are adopting GSM and some signaling protocols, they are becoming closer, the system that we have in

development today, in ten years time, I cannot see the network that start to deploy would have different types of access methods.

Do you think there is a large development cost for this change?

Yes, it is something in plan, it is not something that is going to happen, it is happening. In the international forms now are designing on the protocols for the future. Anyone could access to the single network with any devices, which naturally means the single platform network.

Interview Five:

1. **Could you please explain the role of your company in the telecommunication and Internet market? For instance, network operator, Internet service provider or virtual service provider.**

In general, question one is concerned with the introduction of the business and the related services. All answers to interview question 1 are introducing the interviewees, companies and the Internet services, thus this information will not be presented in this section, and perhaps the researcher will use some of the information in other sections of the study.

2. **Could you please briefly describe the telecommunication and Internet market mix in New Zealand? (for example, Competitors, partners, major / minor players in telecommunication and Internet market)**

Vodafone and Telecom share the Mobile Market in general, Woosh Wireless in particular, is an ISP currently expanding its wireless network and its focus is wireless broadband and the related services. Woosh and Call Plus build the own network, we are no longer reselling the services or solutions from the larger players in the market, such as Telecom, Vodafone and Telstra Clear. In the DSL market, no one can compete with Telecom, some other ISPs, such as Orcon, Worldnet; they are located in the lower level in the market as they are the DSL reseller.

3. **Do you think that the Internet competition has moved from fixed-lined Internet to mobile / wireless Internet? Could you explain further to your answer**

Not really at this time. Mobility indeed offers convenience to us, and the customers can use broadband access and connectivity without a location limit. If I am a user to choose fix-line broadband and mobile broadband, I would say fix-line broadband is better one, because it is faster and more stable. The only thing that might push me to use mobile or wireless broadband is: while I want to move, and fix-line Internet is not available. As the number of customers and their desires on mobile Internet is not as many as the fix-line broadband, I think that the major competition is still lying on fix-line broadband. But, mobile and wireless will be well accepted and deployed definitely, and there is a slow process from fix-line to mobile. Bundling of fixed and mobile is likely being critical for ISPs in the futures the technologies really converge. In particular, the FMC strategies highlight the opportunity and importance of providing both fix-line and mobile services.

4. **Does your company offer or plan to offer mobile Internet services? If the answer is yes, could you please briefly describe the service and deployment?**

In general, question one is concerned with the description of the mobile and wireless broadband deployment and services. The answers to this question may allow the audiences to guess the participants, thus some information will not be presented in this section, and perhaps the researcher will use some of the information in other sections of the study.

5. **In your opinion, what specific requirements does a mobile Internet deployment model need to meet in order to fit in the New Zealand market and competition?**

We should think about the cost, as a service provider. Price is the most important feature that an Internet user will primarily look at and compare with. Apart from that, coverage, bandwidth, speed, performance, perhaps customer services are also important while deploy Internet services to end users. As I believe, while different service providers offer the same level performance services, the customers will compare the prices; in another way, while the service providers are offering the services with the same price, the customers will look at the performance.

6. **Some technologies (for example, CDMA networks, WiFi and WiMax) are available to deploy mobile Internet services presently; could you please give me some personal ideas about – the strengths and weaknesses of each deployment model?**

WiFi, perhaps, en, hotspots is not a good solution to offer mobile service, such as mobile Internet services. It is very difficult to build a large area wireless network with WiFi, as it requires a large number of access points. Also WiFi is not a cost-effective and technical-effective solution. WiFi could be used in some particular areas such as in the office, in the coffee shops. WiFi is good because it has high speed of connectivity, maybe better security, but I don't think WiFi supplies mobility. People can only move in a very small area, the WiFi coverage, and the technology is not entirely well developed for roaming between access points and WiFi networks.

CDAM is the current leading technology in New Zealand market, although it has quite a good space for updating, and there is a long developing process for CDMA evaluation. But, I cannot see a big future to CDMA technologies. The major problem of CDMA network is the huge cost for its upgrade process. When huge amount of money is spent, the improvement if the network performance is not that big as expected. Therefore, I don't think CDAM can drive a long way in the future.

WiMax is probably a good thing to think about now. And in fact WiMax is considered as a big thing after 3G, I would say it is something between 3.5G and 4G in the

wireless and mobile evolution. WiMax just started offer commercial solution in New Zealand, what is good? En, it is easy to deploy, with better coverage, with better speed and performance.

7. **Do you think mobile Internet will contribute to the convergence of networks (for example, stationary Internet and the mobile network), technologies (CDMA, WiFi and WiMax) and services? And how?**

Yes the convergence of network will happen shortly, it is not a long process, and I think single technology will run on the future network and the old technologies such as CDMA, WiFi or WiMax will be disappeared. We have multi-networks with multi-technologies now; the next step is single network with multi-technologies, what is the end of Internet / IP evolution? Something comes to my mind, might be driving to single network with single technology.

Mobile Internet, it is contributing to the convergence of network presently, mobile Internet is a service that links mobile network and Internet together. Let's say in another way, both mobile network and Internet could supply mobile Internet services now, mobile Internet can be offered with different technologies, such as CDMA networks, WiFi and WiMax. Just think about that where we are currently, the concept of mobile Internet is leading the movement from the step 'multi-network with multi-technology' to 'single network with multi-technologies'.

For the services, no matter what network we are using, what technologies we are using, services are more depending on the customers' desires, the network and technology will influence the performance of the services, it will not have impacts on the services types. And for instance, Internet is a kind of service, it can be deployed in different methods, when Internet is available, no matter how Internet become available, the Internet related services (for example, email, online banking) are offered.

8. **Could you please describe how will mobile Internet deliver end user services based on the converged networks and technologies? (for example, cross network, multi-technologies)**

In the near future, a cell phone will be able to select the networks in particular areas. For instance, in New Zealand, the mobile devices could select from either Telecom's CDAM network, Vodafone's WCDMA network or Call Plus's WiMax network. Also, to the mobile devices will but built as multi-technologies enabled, such as WiFi enabled, WiMax enabled, such and such. Users could choose the best way of connecting to the Internet; choose the best network and technology to have Internet services in the multi-networks and multi-technologies environment.

The end user services, for instance, M-mobile service, M-payment, GPS services are become popular nowadays in many counties; the mobile solution and application are built based on the mobile devices and Internet.

9. What would be the most appropriate mobile Internet deployment model or solution to New Zealand market based on your personal ideas and experiences?

I cannot see what is going to happen in the next 10-20 years, and I am sure that there will be something good to overtake the CDMA, WiFi or WiMax. A suitable mobile Internet deployment model or method in New Zealand, I would say WiMax at this moment. WiMax fits the requirements in terms of ‘mobility’, ‘cost-effective’, ‘performance’ and ‘customer expectation’. For some ISPs, WiMax would be a good thing to be considered, and WiMax takes some advantages to compete with the current CDAM technologies, definitely, WiMax could be understood as an enhanced technology to WiFi, once WiMax becomes mature and well accepted, WiFi will be totally disappeared.

Again, Telecom is the single player in the DSL market. Now, there is a shift from fix-line to wireless / mobile, wireless broadband and mobile broadband makes the market become more competitive. It is a headache for the CDMA operators such as Telecom to think about new technologies, such as WiMax now, as they have already built up the CDMA networks and spent huge amount of money on CDMA development. As I said, CDMA is not a long term mobile solution, and I believe that the CDMA players do realize this; they are making hard decision now, whether use the cheaper, faster technology such as WiMax, and slow down their CDMA upgrade.

Appendix III: Invitation Letter

An Invitation Letter

Raymond Huang

School of Computer and Information Sciences

Auckland University of Technology

Phone: 021-681218, Email: cwh0409@aut.ac.nz

Dear Prospective Participant:

My name is Raymond Huang; I am a Master of Computer and Information Sciences student at Auckland University of Technology.

I intend to conduct a research study for my Master's thesis, and I hope that you would agree to participate in my research. My research topic is "A Comparative Study of the Mobile Internet Deployment Models in New Zealand". As you are an expert in the field, I would like to interview you, in order to gain further knowledge in this area. The interview will take approximately 30-40 minutes. Several questions will be asked during the interview and I will use a tape recorder for recording. The recorded information is considered private; and it will be used in my thesis only, not for other purposes. More information about this project is provided in the attached "Participant Information Sheet".

Your participation is voluntary, if you accept my invitation, please sign the enclosed "Consent Form", and post it using the self-addressed envelope. I hope that I will be hearing from you soon.

For your convenience, here are my personal details:

Researcher: Raymond Huang; **Gender:** Male; **University**: Auckland University of Technology

Program: Master of Computer and Information Sciences;

Phone: 021681218; **email**: cwh0409@aut.ac.nz

Thesis supervisor: Krassie Petrova, Senior lecturer, kpetrova@aut.ac.nz

Yours Faithfully

Raymond Huang

Attachments: Participant Information Sheet, Consent Form.

Appendix IV: Participant Information Sheet

Participant Information Sheet

Date Information Sheet Produced:

22nd January 2007

Project Title

A Comparative Study of the Mobile Internet Deployment Models in New Zealand

An Invitation

An invitation letter is provided, please note that your participation in this project is entirely voluntary.

What is the purpose of this research?

- To establish the scope of the current services offered and gauge the extent of perceived customer satisfaction.
- To describe the market mix (major and minor players, vertical integration, and convergence).
- To examine the range of potential issues related to the business model used and investigate the future plans and anticipated developments.

How was I chosen for this invitation?

You were chosen as one of the leading mobile Internet service providers in New Zealand, and because of your expertise in mobile Internet strategies and deployment.

What will happen in this research?

The researcher will interview the participants, several questions will be asked and discussed, and each interview will take 30-40 minutes.

What are the discomforts and risks?

None anticipated, however due to the nature of the project, some questions may appear sensitive.

How will these discomforts and risks be alleviated?

You could choose to refuse to answer some questions or answer them very briefly.

What are the benefits?

- An analysis of different mobile Internet service deployment models will be conducted and the strengths and weaknesses of the different models will be evaluated;

- The mobile Internet competition in New Zealand will be assessed;
- A suitable deployment model will be proposed and the current and future trends of mobile Internet service in New Zealand will be identified.

How will my privacy be protected?

The information gathered from you as a participant will not be used for any other purposes apart from the thesis. Information used will be completely anonymised.

What are the costs of participating in this research?

45-60 minutes of your time

What opportunity do I have to consider this invitation?

You have a 2 week period to make a decision and contact me, if you agree to participate. Your participation is entirely voluntary.

How do I agree to participate in this research?

By signing the "Consent Form" and returning it to me.

Will I receive feedback on the results of this research?

I will be happy to send you a report if you would wish so.

What do I do if I have concerns about this research?

Any concerns regarding the nature of this project should be notified in the first instance to the Project (Thesis) Supervisor, Krassie Petrova, krassie.petrova@aut.ac.nz, 09-9219999 ext 5045.

Concerns regarding the conduct of the research should be notified to the Executive Secretary, AUTEC, Madeline Banda, *madeline.banda@aut.ac.nz*, 921 9999 ext 8044.

Whom do I contact for further information about this research?

Raymond Huang, (a master of Computer and Information Sciences student at Auckland University of Technology);

Mob: 021681218;

Email: cwh0409@aut.ac.nz.

Krassie Petrova Phone: 09-9219999 ext 5045 email: krassie.petrova@aut.ac.nz

Approved by the Auckland University of Technology Ethics Committee on *20/12/2006,* AUTEC Reference number *06/227*.

Appendix V: Consent Form

Consent Form

Project title:

A Comparative Study of the Mobile Internet Deployment Models in New Zealand

Project Supervisor: **Krassie Petrova**

Researcher: **Raymond Huang**

- ○ I have read and understood the information provided about this research project in the Information Sheet dated 22nd January 2007.
- ○ I have had an opportunity to ask questions and to have them answered.
- ○ I understand that the interviews will be audio-taped and transcribed.
- ○ I understand that I may withdraw myself or any information that I have provided for this project at any time prior to completion of data collection, without being disadvantaged in any way.
- ○ If I withdraw, I understand that all relevant information including tapes and transcripts, or parts thereof, will be destroyed.
- ○ I agree to take part in this research.
- ○ I wish to receive a copy of the report from the research (please tick one): Yes○ No○

Participant's signature:

.....……

Participant's name:

.....……

Participant's Contact Details (if appropriate):

……..

Date:

Approved by the Auckland University of Technology Ethics Committee on 20/12/2006.
AUTEC Reference number 06/227

Note: The Participant should retain a copy of this form.

Appendix VI: Confidentiality Agreement

Confidentiality Agreement

Project title:

A Comparative Study of the Mobile Internet Deployment Models in New Zealand

Project Supervisor: **Krassie Petrova**

Researcher: **Raymond Huang**

- ○ I understand that all the material I will be asked to transcribe is confidential.
- ○ I understand that the contents of the tapes or recordings can only be discussed with the researchers.
- ○ I will not keep any copies of the transcripts nor allow third parties access to them while the work is in progress.

Transcriber's signature:

.....……
……

Transcriber's name:

.....……
……

Transcriber's Contact Details (if appropriate):

……..

Date:

Project Supervisor's Contact Details (if appropriate):
Krassie Petrova, Senior lecturer, School of Computer and Information Sciences, Auckland University of Technology
kpetrova@aut.ac.nz, 09-921-9999 x. 5045

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Approved by the Auckland University of Technology Ethics Committee on 20/12/2006. AUTEC Reference number 06/227