

**REPORT FOR THE COMMERCE COMMISSION
ON NEW ZEALAND BROADBAND QUALITY**

Q3 SEPTEMBER 2008

BY



EXECUTIVE SUMMARY

New Zealand's national broadband performance has been continuously improving over the past six months, driven by industry investment in unbundling, the core network and international capacity.

The Commerce Commission's New Zealand Broadband Index Q3 report shows New Zealand's national index score rose 12% in the September quarter to 3257, representing moderate growth after June's strong 22% increase.

This decrease in the growth rate in part reflects the decision to remove TelstraClear's On-Net DSL results this quarter. TCL has upgraded its own copper network to focus on business services, which are outside the scope of this report. Epitiro-IDC estimates this reduced the national average by up to 2%.

The September result puts New Zealand on a par with the UK, which recovered 18% over the period after a poor Q2 result.

The Commerce Commission publishes the NZBBI as part of its telecommunications monitoring and reporting objectives under the Telecommunications Act. The Index measures twelve ISPs every fifteen minutes on a 24-hour basis across eleven sites in Auckland, Hamilton, Wellington, Christchurch and Dunedin. Broadband quality is evaluated on eight parameters that collectively affect the user's experience of popular services, such as email, browsing, gaming and viewing video.

Key findings this quarter:

- New Zealand is ranked as one of the world's fastest-growing broadband markets. Latest OECD data show that New Zealand's broadband penetration growth was sixth highest in the world in the year to June. Total broadband penetration is 20.4, bringing New Zealand almost into line with the OECD average of 21 for the first time. However the rate of broadband adoption shows signs of moderating this quarter, based on Telecom's September results.
- ISP-I data shows a steady 4% overall improvement in key broadband metrics this quarter, particularly those that affect the user's browsing and email experience. Slingshot and Telecom either trialed or introduced new caching technology, boosting their individual performance scores.
- New Zealand's largest ISPs – Telecom, Vodafone, TelstraClear (TCL), Orcon and Slingshot - all posted increases of between 12% and 39% in their city index scores this quarter with strongest performances in the main city centres. This reflects ongoing upgrade and network re-architecture programmes.
- 'Other' smaller ISPs underperformed the market average with a slower 6% improvement, and showed considerable variation between service providers.
- Unbundled services, available in Auckland, have grown to over 12,000 after just six months, and represent a strong area of growth.

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INTRODUCTION

The New Zealand Broadband Index (NZBBI) is founded on EpiTiro's ISP-I technology, which tests broadband Internet services from the end user perspective. The data provides a robust and independent perspective of broadband performance in New Zealand.

The ISP-I data is gathered from twelve ISPs measured across five cities at eleven sites located relatively close to various Telecom exchanges. ISPs are measured on eight key performance variables (KPVs) that impact the user's experience when browsing content, exchanging email, gaming online or streaming video. The main technology measured is asymmetric digital subscriber line (ADSL) technology. However in this quarter, two weeks of higher speed ADSL2+ performance have been included for the first time.

ISP-I outcomes are indicative rather than representative of New Zealand's national broadband performance. ISP-I has a limited number of controlled test sites that capture many of the variables that are within service provider's direct or indirect control. However the ISP-I tests do not capture other premise-specific factors affecting broadband such as home wiring, customer premises equipment, the number of devices connected to a telephone jack and distance from the exchange.

All data in this report is gathered, processed and indexed by EpiTiro. IDC New Zealand has been commissioned by EpiTiro and the Commerce Commission to review the methodology and provide independent analysis of the presented data and findings. EpiTiro's ISP clients currently include Telecom, Slingshot and Orcon.

Full details of EpiTiro-IDC's reporting methodology are included in the Appendix at the end of this report.

Changes and updates in the September report

Changes to reporting of TelstraClear (TCL) results

In the June report, EpiTiro-IDC separated the reporting of TelstraClear's (TCL's) cable network and its two types of DSL broadband service. 'On-Net' DSL is delivered over TelstraClear's own limited copper network and 'Off-Net' DSL services are wholesaled from Telecom. In this quarter, a further decision was taken to discontinue reporting on TCL's 'On-Net' broadband results as TCL has upgraded this network to focus on the business market, which is outside the scope of this report.

The exclusion of TCL's On-Net results this quarter has an estimated 2% impact on the New Zealand national average.

Going forward, the NZBBI will therefore report on two TCL broadband services:

- **Cable:** TCL owns and operates a hybrid coaxial cable network in Wellington, Kapiti and Christchurch.
- **TCL DSL 'Off-Net':** TCL's 'Off-Net' services are those wholesaled from Telecom, and comprise the majority of TCL's DSL services outside of Wellington, Kapiti and Christchurch where it owns and operates cable networks. After this quarter, this will simply be reported as TelstraClear DSL.

Reporting of unbundling and ADSL2+

This quarter Epitiro began to measure the performance of unbundled ADSL2+ services and new wholesale packages, such as enhanced unbundled bitstream access (E-UBA). ADSL2+ technology offers theoretical speeds of up to 24Mbps, and typical speeds of 8Mbps to 15Mbps. Telecom estimates up to 56% of users are now capable of receiving ADSL2+. Only two weeks of ADSL2+ data have been captured this quarter, but a full quarter of data will be reported on in the December results.

Email Roundtrip Test Issues in Q3

Email data in Q3 does not cover the whole quarter. In Q2 we reported a fault as a result of Epitiro systems initially being incompatible with Telecom's new Yahoo mail platform, which rendered the email tests ineffective. The email test had to be re-configured to recapture this information, with the resulting delay exacerbated by a temporary hardware failure. This affected email results for the second half of Q2 and the first half of the September quarter. For consistency, Epitiro has only reported on email data for the period from August 28 to September 30, when services had been restored.

NEW ZEALAND INDUSTRY PERFORMANCE

Broadband Overview

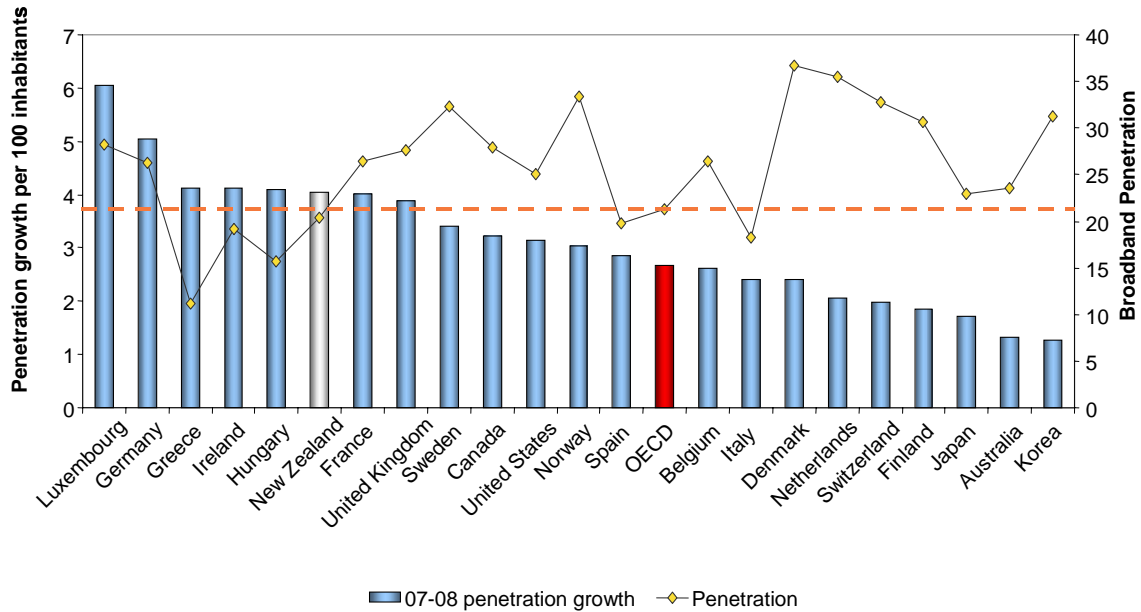
New Zealand's rate of broadband growth over the past year puts it among the top ten OECD countries, although the pace shows signs of moderating in the September quarter.

Latest OECD broadband statistics show that in the year to June 2008, New Zealand's broadband growth was sixth highest in the world, on a par with Germany, Ireland and Hungary. Total broadband penetration per 100 inhabitants was 20.4, bringing New Zealand almost into line with the OECD average of 21 for the first time. In the past two years, New Zealand's broadband penetration has increased 8.8 points or 76% from 11.5 in June 2006.

This means New Zealand's broadband penetration is just a few points behind Australia at 23.5, and on a par with Italy and Spain, but continues to lag leading broadband markets including Denmark (36), Netherlands (35), Korea (31) and the UK (27.6). Figure 1 shows our rate of penetration growth against total penetration for 25 OECD countries.

FIGURE 1

New Zealand's broadband penetration growth – OECD June 2008



*Note: dotted line denotes OECD penetration average

Source: OECD September 2008

While broadband growth continued in the September quarter, as unbundled services, wholesale products and new price plans continued to come on-stream, economic recession and financial uncertainty began to impact the rate of adoption.

Telecom reports that its total retail and wholesale DSL connections increased just 2% in the September quarter to 775,000 (excluding unbundled lines), after 6% growth in the three months to June 08. While this does not include cable and fixed wireless subscriptions, DSL comprises 89% of all broadband connections in June, with cable at 5.9% and fixed wireless at 4.6%. (*Telecommunication key statistics, June quarter 2008, Commerce Commission*)

Telecom's wholesale DSL connections to other ISPs grew by around 15,000 or 6% over the quarter. This excludes unbundled lines, which are provided by Chorus. The Commerce Commission reports the number of unbundled connections is now over 12,000, up from an estimated 3,500 at the end of June. ISPs offering unbundled services report this is their strongest area of growth.

Telecom's retail consumer division captured just 1000 new broadband connections this quarter, representing 0.2% of DSL growth. This is after experiencing strong 6.3% growth in Q2 as a result of its 'broadband at dial-up price' promotion.

Some service providers are reporting that, as economic uncertainty increases, the number of customers migrating from dial-up services is slowing, and there is increased evidence of customers changing service providers, in a practice known as 'churn'.

ISP initiatives this quarter

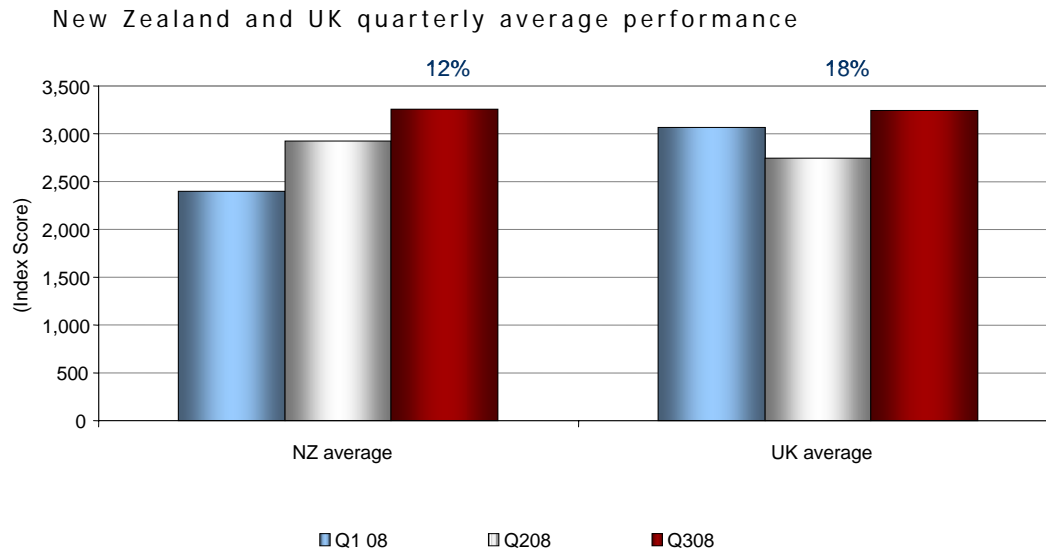
- Chorus reports that its cabinetisation programme is ahead of schedule, with 164 cabinets installed by September, serving broadband to 14,000 customers. Telecom says early indicators show 12Mbps average attainable speed from the cabinet, while high-speed ADSL2+ broadband technology is now available to over 56% of households.
- On September 22, Vodafone announced an agreement to wholesale unbundled services to Slingshot on its new Red network. Slingshot began to transition customers to the Vodafone network in November.
- TelstraClear has launched a new bundle of mobile, fixed and broadband services this quarter, via its new mobile wholesale arrangement with Telecom. While the company has announced it will unbundle between 60 and 80 Telecom exchanges nationally, no further details on its investment plans are available.
- Telecom launched enhanced unbundled bitstream access, known as 'enhanced UBA', to its wholesale clients. Enhanced UBA provides a quality of service that allows telecommunications companies to provide good quality voice over broadband IP (VoIP) and other real-time services.
- Slingshot launched its new solutions for caching content locally, which it says has boosted local and international browsing performance (cached and non-cached HTTP). One feature is its new Akamai global content delivery caching, which hosts locally a substantial array of content, including Microsoft and Apple software updates, Facebook and other popular websites. Slingshot is offering free access to its Akamai caching at the Auckland Peering Exchange (APE) at no charge.

New Zealand's National Broadband Outcomes

New Zealand's national broadband score rose 12% in the September quarter to 3257, representing a more moderate growth rate after June's strong 22% increase.

This reflects, in part, the decision to remove TelstraClear's On-Net DSL results this quarter, after TCL upgraded this network to focus on the business market. Epitiro-IDC estimates this reduced the national outcome by up to 2%.

FIGURE 2



Source: Epitiro, September 2008

The September result puts New Zealand's broadband performance on a par with the UK, which recovered 18% after a poor Q2. Epitiro data indicates the UK's Q2 outcome was partly due to unusually low HTTP download speeds, particularly on international Atlantic links, in addition to email problems.

In comparison to New Zealand, the UK's broadband market provides an interesting reference point. Epitiro measures a total of 19 sites and 10 ISPs in the UK delivering a mix of ADSL2+ and cable services. The UK's broadband penetration is over 27.5% with 16.7 million connections. Broadband has been growing at an average rate of around 4% per quarter, and a significant proportion is in unbundled connections, which more than doubled in the past year to 4.8 million, according to the regulator, Ofcom. However growth in competition has also fragmented the market, and there are indications the deployment of new unbundled services has not always been matched with improved service performance.

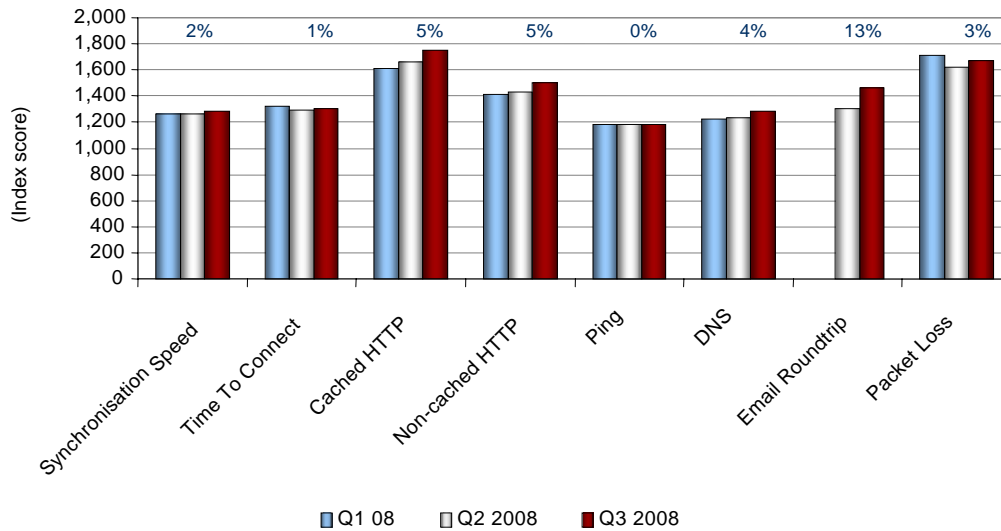
National Key Performance Variables

The NZBBI measures ISPs on eight metrics known as 'key performance variables' (KPVs). The tests are run every 15 minutes on a 24/7 basis over the quarter. The KPVs, individually and in combination, provide insight into the customer's broadband browsing, gaming, email and overall experience.

It is important to note that these KPV scores cannot be compared one to another. For example, the packet loss score cannot be compared to email roundtrip or non-cached HTTP – they each measure entirely different metrics. The value lies in assessing the quarterly changes within each KPV.

FIGURE 3

Key Performance Variables - September 2008



Source: Epitiro, September 2008

In Q3 there has been an overall 4% improvement in the key performance variables, after a flat June result. The strongest area for improvement is in the browsing and email experience as a result of investment in caching, increased international capacity, exchange upgrades, improved backhaul and DNS retrieval technologies.

Web pages are often stored on servers located overseas, which can take time to retrieve and incur expensive international transit costs. By storing or 'caching' content on NZ-based servers, a carrier can improve the retrieval speed and also reduce the amount and cost of international traffic. This quarter, cached services have improved 5%, which has the additional benefit of decreasing the volume of international traffic and improving non-cached HTTP performance. Email roundtrip times improved 13%, after technical issues in Q2. The score for DNS, which measures the time it takes for a web address to be resolved and retrieved, rose 4%, driven by a mix of improved last mile access, domestic backhaul of data and investment in DNS servers

Technical email roundtrip problems in Q2 extended into the first half of Q3. Consequently the Q3 email result only covers the period from August 28 to September 30.

Industry Raw Data

The table below is a quarterly snapshot of the actual raw data generated from Epitiro's testing infrastructure.

TABLE 1

Key performance variables: raw data

	Synchronisation speed	Time To Connect	Cached HTTP	Non-Cached HTTP	Ping	DNS	Email	Packet Loss
	<i>Kbps</i>	<i>seconds</i>	<i>Kbps</i>	<i>Kbps</i>	<i>seconds</i>	<i>msecs</i>	<i>minutes</i>	<i>%</i>
TCL Off-Net	7,263.8	1.7	49.6	37.4	0.223	103.0	1.9	0.2
Telecom	6,701.7	1.6	68.0	56.0	0.192	38.4	1.5	0.3
TCL Cable	na	1.0	111.8	78.5	0.154	56.0	1.6	0.2
Orcon	7,113.0	2.2	67.2	54.9	0.197	48.8	1.6	0.3
Vodafone	6,697.4	2.0	48.7	40.5	0.203	74.0	1.1	0.1
Slingshot	7,057.1	2.4	96.5	62.6	0.183	42.8	1.4	0.2
Other	6,498.6	2.3	42.6	36.6	0.223	99.3	5.8	0.1

Source: EpiTiro, September 2008

ISP PERFORMANCE BY CITY

Overview

Network investment is continuing to deliver rapid improvements in the top five service providers' performance, particularly in the main centres where competitive investment is heavily concentrated. However the rate of improvement shows signs of steadying after a very strong Q2 result.

Telecom, TelstraClear, Vodafone, Orcon and Slingshot have all posted increases of between 12% and 39% in their index scores over the three-month period. 'Other' second tier ISPs show an overall 6% improvement but with considerable variation between service providers.

It is difficult to accurately isolate the reasons for improved performance because of complex carrier relationships. For any ISP, delivering services over infrastructure they don't own or control is a significant variable. Telecom's investment in infrastructure is boosting not only its own performance, but also that of other ISPs that rely on Telecom Wholesale and Chorus's network and backhaul. This is particularly true in the regional centres.

This means a number of key broadband variables captured by EpiTiro, such as synchronization speed and time-to-connect, are exclusively dependent on third party or Telecom Wholesale's performance. Other variables, such as cached and non-cached HTTP, domain name server (DNS) retrieval and packet loss are affected by these third parties but also influenced by the ISP. This means net performance can be attributed both to the ISP and to the third party last-mile network on which the ISP relies.

An increasing challenge for all service providers is managing growth in demand and traffic. Improved broadband access for customers is leading to pressure at other points in the network. Reports of a seven to eightfold increase in streaming media, such as YouTube, is making investment in technologies such as local caching, international capacity and better backhaul critical for managing both performance and costs. This is putting particular pressure on smaller service providers that lack the scale and resources to upgrade their network capability.

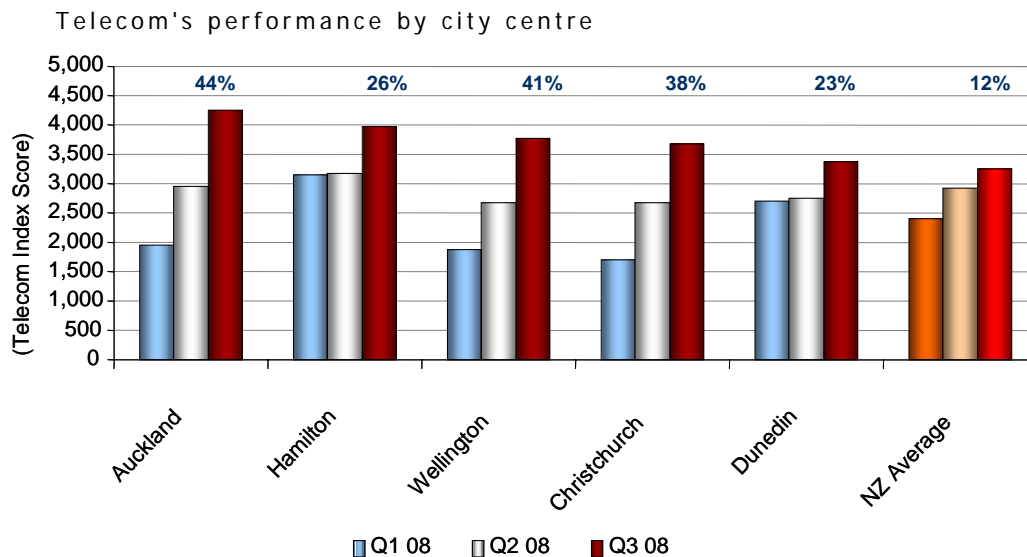
While the overall trend is improving significantly, the Epitiro results also show considerable volatility, and 'growing pains' in provisioning, managing customer transition and technical faults.

Telecom's Quarterly Performance

In the September quarter, Telecom's index rating shows an above-average 35% improvement in all five centres, boosted by investment in caching, changes in network management to improve latency, exchange upgrades, and Domain Name Server (DNS) solutions.

Telecom's index score improved 44% in Auckland (Q2 50%) to 4249, 41% in Wellington (Q2 43%) to 3782 and 38% in Christchurch to 3672. After a flat second quarter, Telecom has lifted its Hamilton and Dunedin results by 26% and 23% respectively. Over the past three quarters, Telecom has improved its overall broadband results by 77%.

FIGURE 4



Source: Epitiro, September 2008

Telecom is attributing this performance to an investment programme that began late last year. Upgraded DNS retrieval services were launched in February 2008, allowing quicker page look up times. In July, the company changed its network management settings in order to lower latency on some plans, which it says is improving performance of latency sensitive applications such as gaming and VoIP. The company is currently trialing new caching solutions, with plans for a full

rollout by Q4 08/Q1 09. In addition, the carrier's Akamai content distribution network has been upgraded earlier this year, which is also improving access times on international applications and content by storing it locally.

Telecom Retail says approximately 50% of its customers are now accessing ADSL2+, following a modem upgrade that began in May.

TelstraClear's Quarterly Performance

TelstraClear's 'Off-Net' DSL results

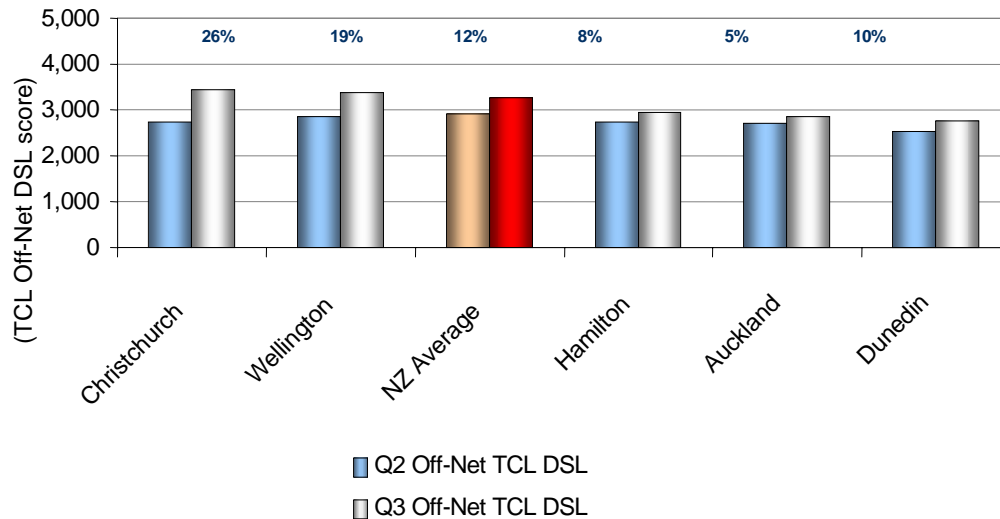
In the September quarter, a decision was made to discontinue reporting on TCL's 'On-Net' broadband services. 'On-Net' DSL delivers broadband over TCL's limited copper network in metropolitan areas. TCL has now upgraded this service to focus specifically on the business market, which is outside the scope of this report. TCL's 'Off-Net' comprises the vast majority of its DSL connections, which are wholesaled from Telecom.

Epitiro-IDC estimates the exclusion of TCL's On-Net results this quarter reduced the New Zealand national average result by up to 2%.

The change in reporting methodology means TCL's Off-Net DSL performance is only reported for the last two quarters.

FIGURE 5

TelstraClear's Off-Net DSL performance by city



Source: Epitiro September 2008

In the September quarter, TCL's Off-Net DSL scores have improved 26% and 19% in its strongest broadband markets of Christchurch and Wellington, putting it just ahead of the New Zealand average. The company has reported a slower 8% to 10% rate of improvement in Hamilton, Auckland and Dunedin.

TelstraClear is heavily promoting its new broadband, mobile and home phone bundles for the residential market, and is encouraging usage by offering

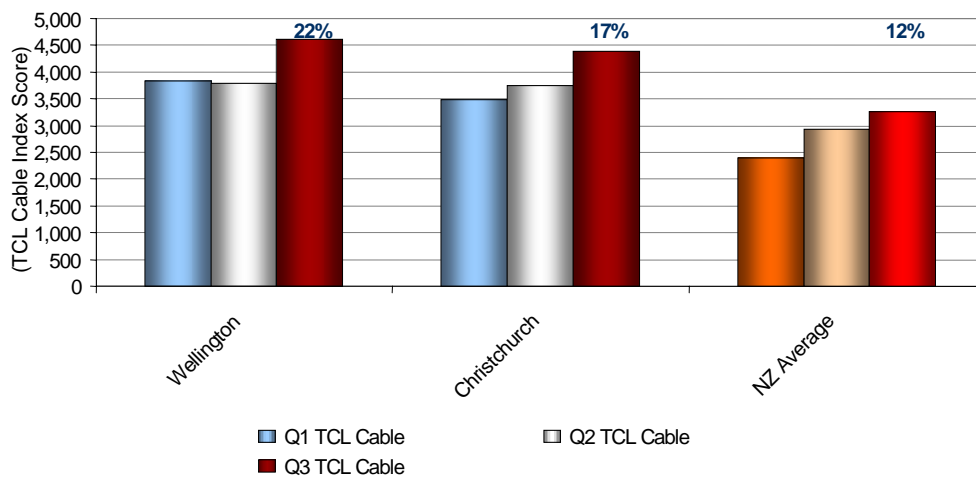
unmetered data usage for local websites such as TradeMe or when viewing video content on its website, clearnet.co.nz. While it is also trialing and promoting the high-speed VDSL2 technology, which will be available in 14 centres by Christmas, this is focused on the business rather than consumer market.

TelstraClear's Cable result

After a relatively flat Q2 performance, TelstraClear's Cable index score has risen 22% in Wellington to 4612 and 17% in Christchurch to 4376, putting it up to 42% ahead of the New Zealand average.

FIGURE 6

TelstraClear's Cable performance by city



Source: Epitiro, September 2008

TelstraClear has been upgrading its cable network capability as part of a 'Warspeed' initiative. Going forward it is publicly committing to delivering a new generation of set-top boxes, including a personal video recorder that can receive standard and high-definition channels from Sky, TVNZ and TV3. Further details have not yet been released.

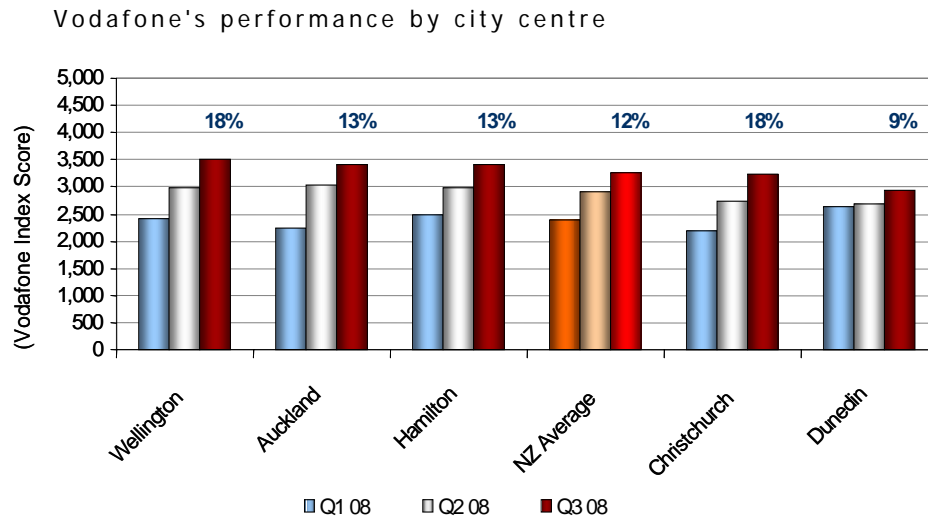
Vodafone's Quarterly Performance

Vodafone is continuing to deliver a steady and consistent 14% average improvement in its broadband score across all five cities, boosted by a strong packet loss score.

Vodafone's Q2 score improved 13% in Auckland to 3413, and 18% in Wellington and Christchurch to 3515 and 3224.9 respectively. However its South Island scores in Christchurch and Dunedin, while improving 18% and 9%, continue to sit at or just below the New Zealand average.

However it is important to note that these results do not capture the full impact of Vodafone's recent investment in new high-speed ADSL2+ and VDSL technologies, particularly in the Auckland region.

FIGURE 7



Source: Epitiro, September 2008

In November, Vodafone completed the unbundling of 40 exchanges, covering 88% of Auckland fixed lines. It is introducing both ADSL2+ and VDSL2, which can deliver broadband of up to 50Mbps over short distances, as a premium service offering. Vodafone is now extending its unbundled services to Slingshot on a wholesale basis and will expand its unbundling footprint to an estimated 20 other exchanges. These will be captured in future quarters as Epitiro incorporates ADSL2+ data measurement.

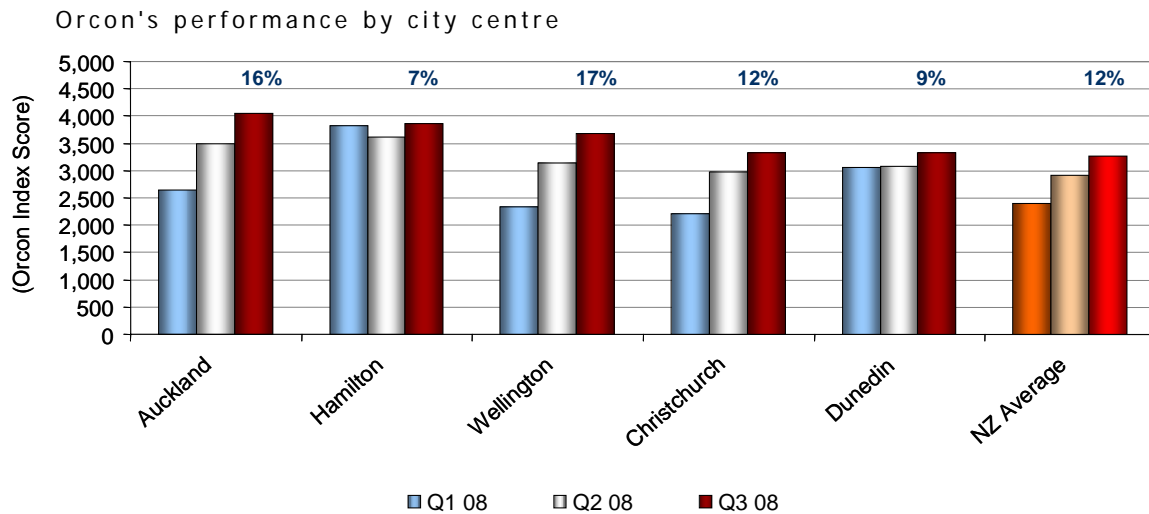
Orcon's Quarterly Performance

Orcon's broadband results are above average in all five centres, but show the strongest 12% to 17% improvement in the main centres of Auckland, Wellington and Christchurch. Hamilton and Dunedin reported lower single digit growth.

This takes Orcon's broadband scores to 4042.2 in Auckland, 3672 in Wellington and 3334 in Christchurch.

While this represents a moderating of the 32% to 35% rate of improvement in Q2, these outcomes do not reflect Orcon's unbundled ADSL2+ performance and only partially reflect its recent network investment.

FIGURE 8



Source: Epitiro, September 2008

Orcon had completed installing its own equipment in 33 exchanges by the end of September and says it is seeing the strongest growth in these unbundled services, which in turn is driving rapid growth in data traffic, particularly on international routes. This has led to an upgrade of Orcon's international capacity by 10% per provisioned user, helping to underpin a strong improvement this quarter in its non-cached HTTP score, which captures international transit. The company continues to invest in its data centre capability and is looking at introducing caching but says it is yet to be satisfied on security concerns.

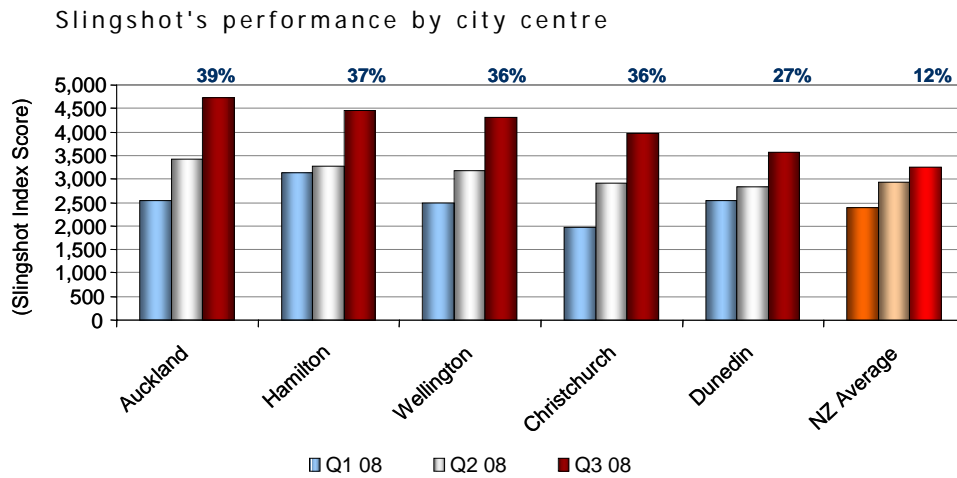
Slingshot's Quarterly Performance

Over the past year, Slingshot has invested in overhauling its core network architecture. This has included upgrading its broadband remote access servers (B-RAS), which route traffic to and from the DSLAM equipment in the exchange to a service provider's network, and its Domain Name Servers (DNS) earlier this year.

From June, Slingshot introduced caching for the first time, providing a shot in the arm to its local cached traffic performance and, in turn, freeing up international traffic and improving non-cached HTTP performance.

This is reflected in Slingshot's city scores which all rose 27% to 39% in the September quarter. Auckland performance rose 39% to 4734.5 and 36% in Wellington and Christchurch to 4321.72 and 3960.87 respectively. All scores are above the NZ average.

FIGURE 9



Source: Epitiro, September 2008

Slingshot has chosen to wholesale unbundled services from Vodafone rather than invest in its own equipment in the exchange. New services via Vodafone wholesale will come on-stream in Q4 08.

Slingshot's network initiatives include:

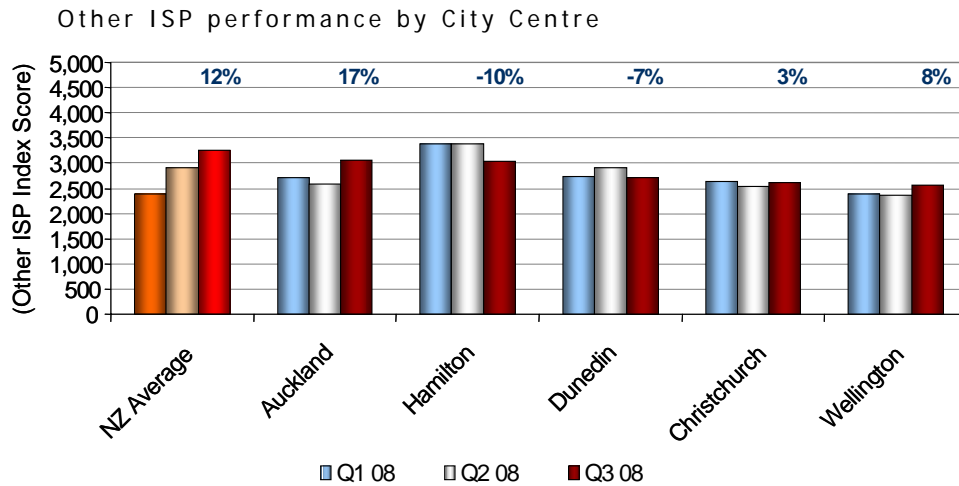
- Upgrading its connectivity arrangements with Telecom from ATM technology to Gigabit Ethernet, which the company says is improving packet loss performance. This is beginning to be reflected in the NZBBI results.
- Upgrading its Radius servers to improve the time it takes for authentication.
- Introducing a second Auckland data centre to increase capacity and provide back up in the event of an outage
- Continuing to increase international capacity by 20% to 30%.

Other ISP Quarterly Performance

The aggregated performance of 'other' ISPs continues to be flat or in decline, with an overall steady performance by individual ISPs pulled down by one or two weaker results.

The 'other' group includes results from WorldxChange (11 sites); Snap (1 site), Actrix (1 site), Compass (2 sites), MaxNet (2 sites) and Inspire (3 sites) and Woosh DSL (4 Sites)

FIGURE 10



Source: Epitiro, September 2008

A challenge for smaller ISPs is the inability to match the scale of investment, caching or international capacity provisioning undertaken by the top five carriers. Wellington ISP Actrix installed its own equipment in a phone exchange in Central Wellington in September, and has plans to extend beyond this. However it has not yet begun connecting customers.

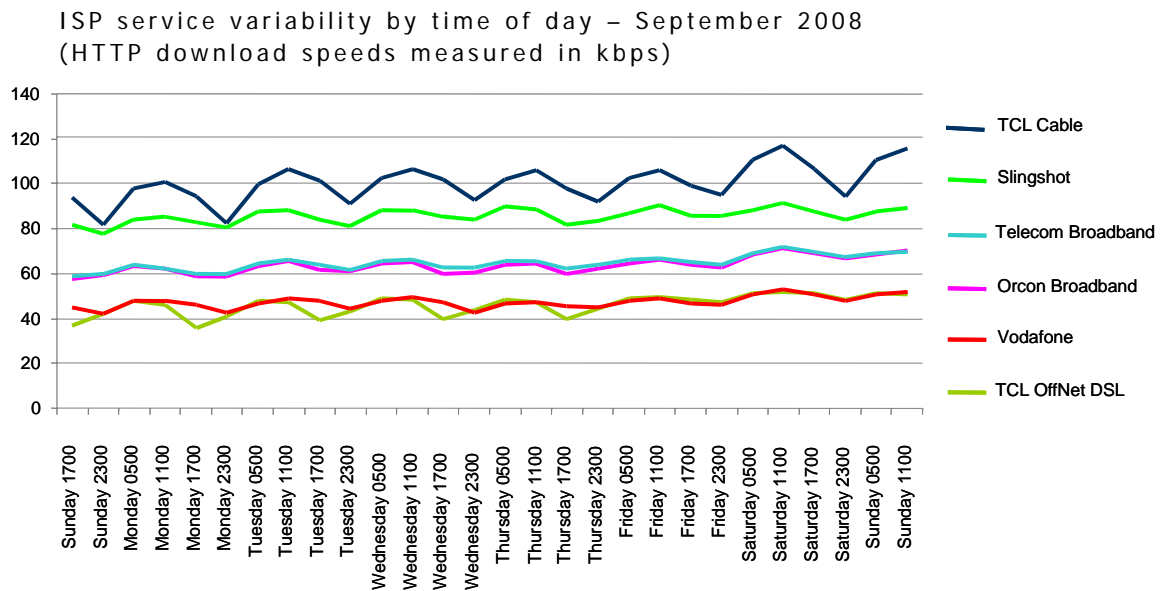
Many of these smaller ISPs are positioning themselves as specialist or regional providers, rather than mass-market players, and will capitalise on new wholesale services as they become available.

SERVICE VARIABILITY BY TIME OF DAY

Service variability is a new measure introduced in the last quarter. Its purpose is to provide insight into the degree of variation that can occur in an ISP's service over a specified period of time, based on peak and off-peak times in the day.

Figure 11 below shows service variability across a month based on cached and non-cached HTTP data, which impact the user's browsing experience. Four data points each day are shown - 5am (off peak), 11am (peak), 5pm (peak) and 11pm (off peak). For each ISP, EpiTiro has captured these daily data points over a month, and then averaged the result for consistency. Figure 11 shows the outcome expressed over the course of a week. For comparison, we have also included the Q2 service stability graph (Figure 12).

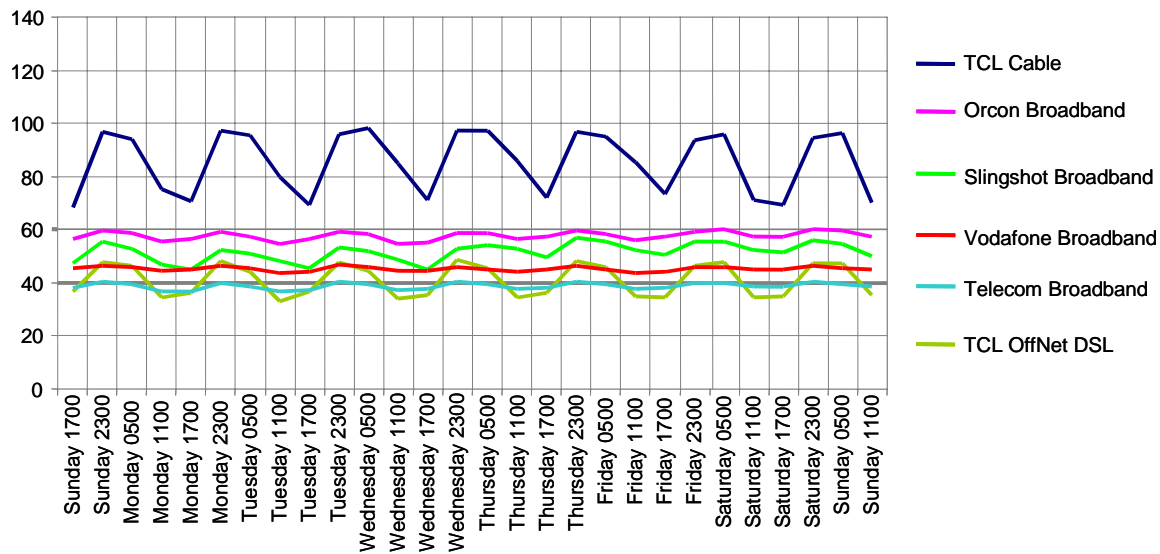
FIGURE 11



Source: EpiTiro, September 2008

FIGURE 12

ISP service variability by time of day – June 2008
(HTTP download speeds measured in kbps)



Source: Epitiro, September 2008

Two significant changes are reported this quarter. Firstly, the degree of service variation between peak and off-peak periods has smoothed out across all ISPs over the period. The exception is TelstraClear Cable, which continues to have the highest speed but highest degree of variability.

This may be largely due to the nature of cable. ADSL has a certain amount of bandwidth per copper line and, as more users come online and compete for bandwidth, contention is created in the backhaul during peak times. This can be remedied by adding more backhaul capacity. Cable, on the other hand is a shared medium where a whole street can literally share the same piece of physical wire. This makes it more challenging for the cable operator to manage contention at peak times, apart from prioritizing certain types of traffic.

Second, there is an overall uplift in performance by ISPs over the week. In Q2, the majority of DSL-based ISPs were delivering peak and off-peak results of between 35kbps and 60kbps. In September, Slingshot, Telecom and Orcon's HTTP results were within the 60kbps and 90kbps range, with Slingshot and Telecom in particular improving their download performance in September, when compared with June.

There is also an overall trend towards better service performance towards the end of the week. This partly reflects the fact that Epitiro's new ADSL2+ modem tests came on-stream at the end of September. One week of higher-speed ADSL2+ data performance has therefore been captured in the Saturday and Sunday measurements, contributing to an end-of-week lift in average performance.

CONCLUSIONS

This third quarterly NZBBI report shows New Zealand's broadband performance is improving at a rapid rather than incremental rate, although this quarter has shown the first signs of moderating growth as New Zealand entered recession.

It reflects the impact of new infrastructure investment and technologies, particularly in areas of greatest population density. However it suggests a widening of the performance gap between the leading mass-market service providers and smaller specialist ISPs that lack the financial capability to directly invest in service performance but depend on wholesale capability.

The introduction of ADSL2+ data into the NZBBI is likely to further boost results in future reports, and provide a more comprehensive picture of recent investment and performance from unbundled service providers. Growth in the number of cabinet connections and enhanced UBA will also drive outcomes. However it may introduce more volatility and variation in service performance.

It is difficult to forecast at this point the impact of economic recession on broadband subscriber growth and the industry. A significant slowdown will, in time, impact industry investment plans and competitive positioning.

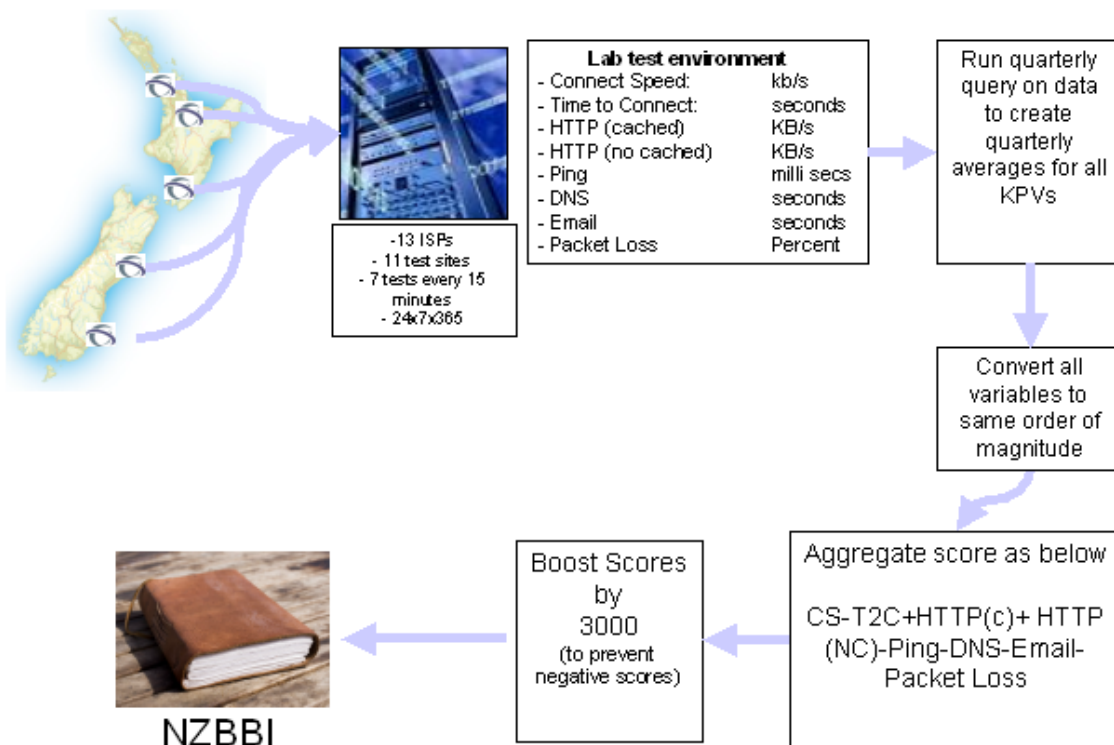
The NZBBI today provides a valuable benchmark for tracking and measuring that change at a national level over time. Nevertheless it is important to recognize the NZBBI is at an early stage in the reporting process, and the range of 'normal' quarterly variation and underlying trends will only begin to become clear after four or more quarters.

APPENDIX - METHODOLOGY

The methodology used in creating the New Zealand Broadband Index (NZBBI) has been tested and evaluated through a process of industry consultation and independent review.

The NZBBI does not report absolute results. Instead the raw data is aggregated and then weighted to provide a consistent indexed score for comparison, as described below. The quarterly raw data comprises literally tens of thousands of tests, which are conducted at 15-minute intervals on a continuous 24-hour cycle on all broadband services measured.

The Index Process



Report collation methodology

There are three principle steps in the formulation of this report:

- Data Gathering:** The data is collected and managed via Epitiro's ISP-I service. The ISP-I platform consists of a centralised database and reporting system along with geographically diverse deployment of ISP-I-configured PCs or 'Satellites' that are responsible for collecting data on the performance of the monitored network services. Testing is maintained 24x7, with each ISP's service tested every 15 minutes. Tests are performed using PCs that are of a specification typical of those available for home use, which run the ISP-I software. A consistent specification is maintained across the ISP-I network. All satellites are installed with Microsoft Windows XP Professional SP2, with the Windows Firewall enabled. In order to test each ISP's services, Epitiro

has subscribed to the premium broadband service available from each ISP at each of its physical testing sites. Epitiro's ISP-I Satellite software runs on Windows and employs Microsoft's .NET framework to control the connectivity and execute tests as and when required. The ISP-I Satellite integrates very closely with the Windows Operating System, which means it uses exactly the same underlying mechanisms as an end user connecting to the Internet and to the services made available via their ISP. More detail on how the ISP-I Satellite software performs its tests is given below.

- **Data Processing:** This stage of the process is managed by Epitiro, and involves the indexation of the raw data. Indexation occurs for two reasons:
 - To allow the data to be aggregated and manipulated. Because the tests involve a variety of measures including milliseconds, kilobits per second and percentages, the results exist in a myriad of orders of magnitude. To allow greater flexibility in analysing the data, all of the values are converted into a score of the same order of magnitude.
 - Depending on the variable, a high result will, in some cases, be an indicator of good performance and in others suggest a worse performance. For example, a high synchronisation speed performance is positive, whereas high packet loss is negative. In order to make the report easier to read and to create consistency, indexed numbers have been re-weighted using statistical techniques. As a result, a high index score always indicates a positive performance in this report.
- **Data analysis and report preparation:** The period of analysis is selected in the ISP-I system and in this case represents three months of data. The system averages the results of every test conducted for every ISP across this period. Over time a database of quarterly processed and indexed results will develop for analysis and comparison in quarterly reports.

Key Performance Variables tested

There are eight key performance variables (KPV's) analysed in this report, with two additional parameters assessing consistency of service performance and traffic management. The KPV's are defined as follows:

Synchronisation speed

Synchronisation speed is one measure of the speed of broadband service supplied to a customer. Line connect speed is the synchronisation speed reported by the modem after connection to the ISP has been initiated. It represents an upper limit on the customer experience; sustained data rates are often slower than the synchronisation speed. When connecting to a service via a modem (this includes dial-up, ADSL, fixed wireless and mobile / HSDPA / GPRS broadband connections), the ISP-I Satellite software employs the Windows RAS APIs to initiate the connection. This is the same underlying mechanism that an end user would be using when they manually initiate a connection to their ISP. In the case of connections that use the Satellite's ethernet connection, such as cable or router connections, the Satellite software is able to confirm existence of an active connection, but does not capture any timings, synchronisation speeds or specific failures as the connection itself is managed by the cable modem or router.

Time to Connect

“Time to Connect” measures the average time it takes for an ISP to recognize a broadband modem and connect it to the network after it is turned on. The Satellite captures accurate timings for events that occur during the initialisation and setup of the connection (e.g. user authentication and IP address allocation), as well as the synchronisation speed itself as reported by the modem. Additionally, where a connection failure occurs, the ISP-I Satellite records the specific RAS error code returned by Windows Dialup Networking. This variable will not be tracked from Q4, because Epitiro is upgrading all sites to ADSL2+ for the Q3 report to reflect changes in the market. This variable cannot be captured from ADSL2+ modems.

Cached HTTP

Web pages are stored on servers that are often located in foreign countries. To improve retrieval speed and reduce international transit costs, content fetched by users may be locally cached on NZ-based servers. The cached HTTP download speed test indicates how quickly an ISP can distribute content over the New Zealand portion of their network by testing how fast specific web pages are downloaded. The HTTP test makes a request to the specified URL and records the time taken and the amount of data downloaded, from which the speed of the download is derived. Depending on the configuration of the test, the satellite is also able to download the embedded content, such as images on a web page, in any HTML that results from the HTTP request. Any additional content downloaded is reflected in the captured timings and size of data downloaded. Epitiro has selected a basket of the websites most frequently accessed by local users.

Non-cached HTTP

The HTTP test can be configured to run in one of two modes of operation: cached and non-cached. When the test downloads from the specified URL in “cached” mode, the speed of the download can be impacted by any caching mechanisms used by the network provider/ISP connected to the PC satellite. The non-cached HTTP download speed test ensures that the web page request bypasses any caches present in the network, and so goes all the way back to the original website, making use of international bandwidth where necessary. This download speed test therefore provides an estimate of the user experience in downloading web pages from foreign locations. Short times equate to a better experience. The “non-cached” mode appends a random query parameter to the end of the URL, which will result in the request bypassing any caches present in the network. The web server specified in the URL, as opposed to any cache, will therefore service the request. If a failure occurs then the HTTP status code is recorded. This can be used as an indicator as to whether the error resulted from the network or from a problem with the web server hosting the URL. Epitiro has selected a basket of popular URLs located in the various regions of the world – the US, Asia and Europe particularly – to test the quality of each ISP’s international connectivity.

Ping performance

A ‘ping’ is the time taken for a device on the Internet to send a request to a remote server and for that server to respond with an acknowledgement. The ping time test is a measure of how quickly the ISP’s network can respond to a request, so it is also known as a measure of latency. Shorter ping times are better. The Ping test measures network latency by sending an ICMP echo request to the specified server. The time recorded by the ISP-I Satellite is the total round trip time (in

milliseconds) from the request to the echo response being received from the server. The ping test is conducted on the same basket of URLs used in the HTTP tests.

Domain Name Server performance

A Domain Name Server (DNS) fulfills a function similar to a telephone directory. A DNS server takes an address readable by humans (e.g www.comcom.govt.nz) and converts the address to an IP address, or a specific set of numbers which identifies a particular website. In technical terms, the DNS test records the time taken (in milliseconds) to resolve a domain name to a corresponding IP address. The DNS servers used for the query are those primary and secondary servers dynamically assigned by the service provider when the network connection is initiated. Alternatively a specific DNS server can be configured for use during DNS tests. The ISP-I Satellite delegates responsibility for DNS resolution to the underlying operating system, thus using the same DNS resolution mechanism employed when a user enters a URL into a web browser. More details of the specific DNS resolution algorithm used by Microsoft Windows can be found in the Windows XP Resource Kit (Configuring IP Addressing and Name Resolution). Satellites ensure that the DNS query is performed on the DNS servers, and not returned from any local cache, by disabling the Windows DNS Client Service responsible for caching the results of DNS requests.

Email Round Trip

The email roundtrip test measures the time that it takes for an email to be sent over the Internet using the ISP's mail servers. If these servers are busy then they may take a longer time to send a message: a shorter time therefore provides a better experience. In technical terms, email testing within ISP-I consists of SMTP tests that run from the Satellite and POP3 tests that are run centrally to retrieve the emails from the POP3 mailboxes. The SMTP test executed by the Satellite can be configured to send an email using the service provider's SMTP server to one or more recipients. Each email sent can be uniquely identified by an ID transmitted in one of the email's headers. The Satellite records the time taken to send the email using the SMTP server, and also any SMTP error codes that result during the course of the conversation with the server. The POP3 component of the ISP-I platform's email testing is performed from centrally managed servers that are configured to poll the mailboxes of each POP3 account once every minute. Whenever an email is retrieved that was sent from an ISP-I Satellite, the time of retrieval is recorded. Any errors that occur while attempting to connect to a POP3 server are also recorded.

Packet loss performance

The packet loss test records the average package loss percentage experienced during individual tests and an overall packet loss test. The packet loss test is not an individual test in the same sense as the other tests that the ISP-I Satellite is capable of executing. Instead, the Satellite records TCP packet loss during all the individual tests executed, as well as an overall packet loss measure over the course of entire network connection during which the tests were being run. Thus, as well as measuring the packet loss present in a network, ISP-I is able to indicate whether packet loss is occurring for a particular protocol or service. The ISP-I Satellite measures packet loss by utilising the Performance Counters for TCP available within Windows. Packet loss is recorded as the percentage of TCP segments transmitted from the Satellite machine that contain retransmitted bytes.

ISP Service Variability

Given the contended nature of broadband services, it is useful to try to quantify the undulating nature of these services, specifically around performance over peak and off-peak periods, as this “natural” fluctuation can impact upon customer experience.

The best variable for measuring this variability is HTTP download speeds. For the purposes of this graph, cached and non-cached download speeds were taken for the first three weeks of the month of September and averaged. This data is represented in kilobits per second (Kbps).

The service variability data measures performance at peak and off-peak times each day, represented as averages for all of those days in a month. For example, in Figure 9, Monday at 0500 represents the average of four tests taken for each Monday in September at that time. This was then repeated for each day in a seven-day week. Four tests were conducted daily, at the following times; 0500, 1100, 1700 and 2300 hours.

Other Factors: Broadband Service Experience

The service an ISP delivers to a consumer is not only affected by network-related issues, as measured above; there are factors within the home or business environment that can also play a significant role in repressing broadband service performance. Epitiro’s testing has revealed these factors to include:

- The individual's choice of broadband plan, including speed and size of data cap. This is particularly critical with ADSL2+, where full benefits are only achieved on a 'maximum download, maximum upload' data plan. While Epitiro's ISP-I data only measure the premium consumer plan, Telecom Retail's broadband growth in the second quarter was driven by a limited broadband deal designed to attract customers from dial up.
- Satellite television services, when the decoder is plugged into a telephone jack without an ADSL filter;
- Faxes attached to the telephone jack, even if they are not operating and have a ADSL filter;
- PC hardware specification;
- PC operating system configuration;
- Extent of applications and malicious software or viruses that may be running in the background on a user's PC;
- Telephone line wiring quality;
- Number of cable pairs bundled together (when serving multiple tenancies, for example blocks of flats), and the number of those running broadband services.

The ISP-I data included in this study does not address these factors.

Reporting on Other ISPs

A total of twelve ISPs are measured, but a number were only measured in one site or one city. For consistency, Epitiro-IDC's analysis of key performance variables (KPV's) only specifies the top six service providers measured across all

cities and sites, while the second and third-tier ISPs have been aggregated into an 'others' category. The report does, however, note individual performances where appropriate in the text.

Epitiro is no longer measuring Kiwi Online following its acquisition by Orcon.

Results for all twelve ISPs have nevertheless been reported in each city they have been measured in. The second tier ISPs and sites measured include:

- WorldxChange (11 sites)
- MaxNet (2 sites)
- Inspire (3 sites)
- Compass (2 sites)
- Actrix (1 site)
- Snap (1 site)
- Woosh DSL (4 sites)

Woosh

The NZBBI does not measure Woosh's fixed wireless performance, but does include Woosh's DSL service. This is because the wireless offering is targeted at users who place a premium on mobility rather than high-speed access. Due to limitations in the technical capability of its TDD-CDMA platform it is therefore not directly attempting to compete with DSL providers with its wireless service.