Australian
Competition &
Consumer
Commission

# Telecommunications Infrastructure in Australia 2004

## June 2005

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# Glossary and abbreviations

| | |
|---|---|
| Carrier | The holder of a carrier licence granted under the *Telecommunications Act 1997*. |
| Commission | Australian Competition and Consumer Commission. |
| CWDM | Coarse Wavelength Division Multiplexing is an optical transmission method that increases the existing fibre capacity by combining up to 16 different wavelengths in one fibre. |
| Declared service | An "eligible service" declared by the Commission under s. 152AL of the Trade Practices Act. Once an eligible service is declared, carriers and carriage service providers supplying the service to themselves or others are required to supply the service to service providers upon request — see s.152AR of the Trade Practices Act. |
| Eligible service | This term is defined in s. 152AL of the Trade Practices Act. It is a carriage service between two or more points (at least one of which is in Australia), or a service that facilitates the supply of such a carriage service. |
| Fixed network | A network used to supply telecommunications services, and other communications services (e.g. pay-TV), where the communication must be initiated or received at the subscriber's premises (or within a limited radius of that location). The network can be wire-based or wireless. |
| FTTH | Fibre to the home. |
| HFC network | The hybrid fibre coaxial network, which uses both optical fibre and coaxial cable to deliver services to subscribers. |
| ISDN | The integrated services digital network, which carries communications at higher speeds than are possible using the PSTN. |
| ISM | Refers to a particular part of spectrum (2.4 GHz band) allocated for industrial, scientific and medical applications. |
| LMDS | Local multipoint distribution system. |

| | |
|---|---|
| Local access network | The portion of a fixed network which connects subscribers with a major network node (typically an exchange). |
| MMDS | Multi-channel multipoint distribution service. |
| Mobile network | A network used to supply telecommunications services where the communication can be initiated or received by an individual handset at any place in which the network operates. |
| PAPL | Permitted attachment private line. A simple leased line service which provides transmission at voice frequency. The customer is expected to supply equipment to be used at either end of the line. By attaching a particular type of equipment, users are able to obtain higher capacity transmission. |
| PSTN | The public switched telephone network used to provide standard telephone services. |
| SDH | Synchronous Digital Hierarchy is a standard technology for synchronous data transmission on optical media. |
| Service provider | Defined in s. 86 of the *Telecommunications Act 1997*. Means a carriage service provider or a content service provider. |
| Transmission network | The portion of a network for the carriage of communications between local exchange areas. |
| Trade Practices Act | *Trade Practices Act 1974*. |
| ULLS | Unconditioned local loop service. |
| WiMAX | WiMAX is a standards-based wireless technology that provides high-throughput broadband connections over long distances. |
| xDSL | A generic term for digital subscriber line technologies (ADSL, VDSL, HDSL and SHDSL) which enable broadband services to be provided over copper wires. |

# Chapter 1. Introduction

This report details the stock of telecommunications infrastructure owned and operated by telecommunications carriers operating in Australia at 30 June 2004.[1] It serves to quantify the customer coverage and geographic reach, level of existing and planned investment, network applications, and the extent of competition between infrastructure operators.

This information is highly relevant to the regulatory work of the Australian Competition and Consumer Commission (the Commission) and to market participants and observers more generally. The report is the third such report released by the Commission. The first report, *Telecommunication Infrastructures in Australia 2001*, prepared for the Commission by BIS Shrapnel, was published in July 2001 and the second report *Telecommunications Infrastructure in Australia 2002* was prepared by the Commission and published in October 2003.

Most of the information contained in the report has been derived from the Commission's survey sent to all telecommunications carriers in Australia holding licences at 1 August 2004. At this date there were 98 licensed carriers of whom 55 provided responses to the survey, representing a 56 per cent response rate.

A list of these carriers and those that provided responses is provided at Appendix 1. The carriers that responded included all of the 1st and 2nd tier carriers, with the exception of Soul Pattinson Telecommunications (SPT), and the vast majority of 3rd tier carriers. In general, the Commission was disappointed with the number of carriers that failed to provide a survey response. SPT's omission is likely to have the most impact on the completeness of results. That said, the report captures the vast majority of operational telecommunications infrastructure in existence, but as noted above there are some omissions.[2] Furthermore, in instances where a carrier licence was relinquished prior to 1 August 2004, but infrastructure remains in existence, this will not be captured unless it has been purchased by another carrier.

To accord with reporting conventions and aid ease of survey completion, the information sought by the survey was that current at 30 June 2004. Some limited information was also sought on network plans for the financial year 2004-05. The survey requested information on the following access network types: copper, optical fibre, hybrid fibre coaxial (HFC), fixed wireless, cellular mobile and satellite. Where applicable, separate information was collected with respect to local access networks and long-distance or transmission networks.

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[1] This report does not include telecommunications infrastructure that is owned and operated by large organisations, such as universities, hospitals, large corporates and power and rail utilities.

[2] The more notable omissions include the access networks owned and operated by Soul Pattinson Telecommunications, Agile and ETSA Telecommunications.

The report is divided into chapters, each focusing on a particular type of infrastructure:

- Chapter 2 deals with local access networks. It covers the networks used to deliver telecommunications services, and broader communications services (e.g. pay-TV) using fixed networks.

- Chapter 3 focuses on ISDN and xDSL services.

- Chapter 4 is concerned with transmission services.

- Chapter 5 examines services provided using mobile networks.

- Chapter 6 sets out the conclusions and directions for future reporting on telecommunications infrastructure.

Completion of the survey was entirely voluntary and the Commission appreciates the time and effort taken by carriers to complete the survey. The Commission respects the concerns of carriers regarding the confidentiality of information provided in their responses and, accordingly, much of the individual information presented in this report is commercial-in-confidence. This is designated by shading within tables and of related text. A public version of the report has been produced with this information removed.

In a number of cases, carriers chose not to provide particular items of information to the Commission, or were unable to do so in the format requested by the Commission. This has affected the extent to which the Commission has been able to report on particular aspects of network infrastructure and is noted in relevant sections of the report.

### Limitations to report

The reported investment data are subject to certain limitations which should be borne in mind when drawing conclusions.

1. Major telecommunications infrastructure investment programs occur sporadically and can take long periods to implement. As a result, when viewed on an annual basis, investment levels appear lumpy, with some years recording relatively high or relatively low levels. As such, it is not possible to draw robust conclusions concerning investment levels and associated incentives based upon a single year's investment data or annual changes in that data.

2. The reported investment data (other than investment plans) are current to 30 June 2004 and do not include more recent investments in telecommunications infrastructure. As noted in the report, a large number of investment projects are planned by carriers.

3. As noted above, not all carriers responded to the survey upon which this report is based.

# Chapter 2. Local access networks

## Overview

- Local access networks use a range of distribution media to connect subscribers with network nodes. As at 30 June 2004, the most common distribution medium was copper wire (87 per cent), followed by hybrid fibre coaxial cable (11 per cent). Optical fibre was used for approximately 1 per cent of subscriber connections.

- Nationally, as at 30 June 2004, the majority of subscribers were connected to local access networks operated by Telstra (93 per cent). SingTel Optus was the main alternative carrier with 6 per cent of subscriber connections.

- Despite the presence of multiple local access networks in CBD and metropolitan areas (notably Sydney, Melbourne, Brisbane, Adelaide and Perth), approximately 99 per cent of connections were to networks operated by Telstra and SingTel Optus. Similarly, in provincial areas, as well as rural and remote areas, approximately 99 per cent of subscriber connections were to Telstra and SingTel Optus local access networks.

- During 2003-04, carriers invested around $872.1 million in local access network infrastructure. Approximately one fifth of this investment was undertaken by carriers other than Telstra.

- Telstra and other carriers have planned modest levels of investment in local access network infrastructure for 2004-05. While some of this investment involves asset replacement and upgrade, there are plans to expand copper, optical fibre and satellite networks.

- Third party access to local access networks is not limited to network services declared under Part XIC of the *Trade Practices Act 1974*. Many of the newer carriers are permitting third party access to their optical fibre, microwave and satellite local access networks, suggesting that some access arrangements are being successfully negotiated without the need for regulatory intervention.

## 2.1.    Technical issues

Traditionally, telecommunications networks are classified as either fixed or mobile, based on the degree of mobility that the network affords to subscribers. For instance, with a fixed network, the call must be initiated or received at the subscriber's premises (or within a limited radius of that location), whereas with a mobile network the call can be initiated or received by an individual handset at any place in which the network operates.

Generally speaking, fixed networks consist of multiple local access networks, linked together by a transmission network. Local access networks are also known as the 'local loop' and represent the *last mile* of a fixed network.

The local access network includes the connection between each subscriber and a local network node, commonly known as an exchange[3], by way of particular transmission media such as copper wire, optical fibre or wire-less technology. Normally, the network also includes a further transmission link from this node to a major network node that aggregates and interconnects traffic from a number of exchanges, as shown in Figure 1.

**Figure 1: Local access network architecture**
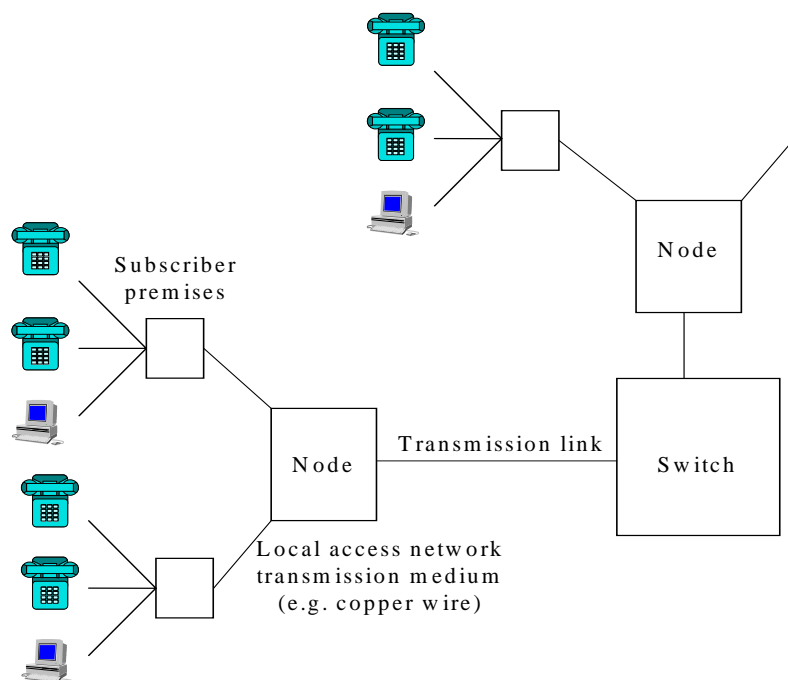


The distribution media used for local access networks include:

- copper wires

- optical fibre

- hybrid fibre coaxial cable (HFC)

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[3]  That said, the term 'exchange' can lead to confusion as it implies that switching is undertaken at that location. This is not necessarily the case — switching may actually occur further upstream.

'Exchange' is commonly used by Telstra to refer to a building in which telecommunications equipment forming the local concentrators, local switching, trunk switching and inter-exchange transmission equipment is accommodated.

- microwave

- LMDS and MMDS

- ISM and modified spread spectrum

- fixed wireless and

- satellite.

Factors influencing the choice of distribution media include service type, subscriber location and density, traffic volume and type, topography, and legacy issues such as the technology available at the time when the network was deployed. Table 1 presents the types of traffic carried, and subscribers served, by particular types of local access networks as at 30 June 2004.

**Table 1: Local access network traffic and customer profile (30 June 2004)**

| Network type | Traffic profile | Subscriber profile |
| --- | --- | --- |
| Copper | voice, data, video, security | R, SB, MB, LB |
| Optical fibre | voice, data, video, security | SB, MB, LB |
| HFC | voice, data, pay-TV | R, SB, MB, LB |
| Microwave | voice, data | R, SB, MB, LB |
| LMDS | voice, data, video | SB, MB, LB |
| MMDS | pay-TV | R |
| ISM and modified spread spectrum | voice, data | R, SB, MB, LB |
| Fixed wireless | voice, data | R, SB, MB, LB |
| Satellite | voice, data | R, SB, MB, LB |

R = retail; SB = small business; MB = medium business; LB = large business

### 2.1.1. Copper

As the traditional means for connecting subscriber premises, copper wire forms the basis of the public switched telephone network, which is used to carry voice and data calls. Copper wires can also be used to carry traffic at higher speeds through the use of ISDN and xDSL technology at each end of the copper line. Historically, copper access technology has been used to supply a wide range of specialised telecommunications services to consumers. These service types include Megalink, Datel, DDS, Voice Grade Dedicated Leased Lines (VGDL), and PAPL.

### 2.1.2. Optical fibre

Optical fibre systems use light waves for the transmission of all forms of telecommunications traffic, permitting the carriage of traffic at high speeds with less interference. At the local access network level, it is used for transmission between network nodes (concentrators or exchanges) and switches, and also for access to the

premises of high volume business subscribers and multi-story office buildings. Optic fibre is also being employed in small Fibre To The Home (FTTH) trials.

### 2.1.3. HFC

HFC involves the use of both optical fibre and coaxial cable to carry traffic at high speeds. The optical fibre connection forms the "backbone", with coaxial cable running from fibre nodes to subscriber premises. Unlike copper wires and optical fibre, which are dedicated connections, HFC is a shared transport medium with specific bandwidths on the network being allocated as required for the transmission broadcast pay-TV or for the transmission of voice calls or data traffic.

### 2.1.4. Microwave[4], LMDS, MMDS, ISM and modified spread spectrum, and fixed wireless

These are wireless systems that use microwave radio technologies to transmit communications. The waves are received and transmitted via antennae and dishes fixed to the subscriber's premises. Each system uses different spectrum bands.

LMDS and MMDS use spectrum in the 27/28/31 GHz and 2.3 GHz bands respectively. Transmission is "line of sight" and for this reason, these systems tend to be used on high-rise office buildings for business subscribers. That said, MMDS is also used for pay-TV applications in low-rise residential areas. Microwave is a point-to-point communications technology, whereas LMDS and MMDS are point-to-multipoint (microwave) distribution systems.

ISM refers to a particular part of spectrum (2.4 GHz band) allocated for industrial, scientific and medical applications. It can be used to supply wireless local area network services. Multiple communications are possible simultaneously using spread spectrum principles to minimise the effect of interference.[5]

An alternative to copper wires, fixed wireless involves the transmission of voice and data calls via radio waves in the 3.4 GHz band. It tends to be used where factors such as subscriber location or topography make this a more efficient means of connection than copper. Fixed wireless is similar to LMDS and MMDS; however, these technologies enable transmission at higher speeds than is achievable with fixed wireless.

### 2.1.5. Satellite

Satellite is predominantly used for video and television transmission (free to air and subscription). It is also used as an alternative to copper wires in remote locations (e.g. where a subscriber is more that 20km from a network node) for voice and data

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[4]   Microwave is common usage for licensed point to point microwave systems. The other named technologies (LMDS, MMDS, ISM and spread spectrum) are all forms of microwave technologies.

[5]   House of Representatives Standing Committee on Communications, Information Technology and the Arts, Parliament of Australia, *Connecting Australia! Wireless Broadband*, November 2002, p. 18.

transmissions.  In addition, it is used to supply some mobile telecommunications services (see section 5.1.1.).

## 2.2.	Network size

Assessment of network size provides an indication of the level of investment in telecommunications infrastructure, as well as providing information about the extent of facilities-based competition.

To assess the size of particular local access networks, relevant dimensions include the number of subscriber connections, traffic volume, network capacity and the quantum of infrastructure (e.g. exchanges, cable).

For the purposes of this report, the Commission used a single dimension to compare network size — subscriber connections.  Primarily, this was due to the ready availability of subscriber data.

That said, the number of subscriber connections is not the only basis on which valid comparisons can be made and, in this regard, also comparing the volume of traffic transported via each network may enable a more comprehensive picture.  For instance, it may be expected that optical fibre links carry a greater volume of traffic than copper lines and thus comparisons on the basis of traffic volumes may facilitate a greater appreciation of the relative importance of optical fibre networks.  An alternative view is that comparison of traffic volume may equally serve to confuse.  For example the volumes of traffic of a pay TV service would swamp the statistics for PSTN services and would not add any real value to the information.

Information about traffic volumes was, however, outside the scope of the data sought by the Commission and accordingly, it was not possible to make comparisons on this basis.  Also, the Commission did not receive sufficiently complete information about network infrastructure and capacity in order for these dimensions to be used as a quantitative basis in assessing network size.

### 2.2.1.	Network type

Table 2 and Figure 2 present information about the number of subscriber connections for each network type.  These networks are used to supply traditional telecommunications services (i.e. voice and data), as well as broader communications services such as pay-TV.  Where a network can be used to supply both fixed and mobile services (i.e. satellite), only fixed network connections are included.

Not all carriers provided information on the number of subscriber connections.  PanAmSat Asia Carrier Services was unable to do so because it does not serve subscribers directly but rather provides capacity to other carriers.  Other carriers chose not to do so; however, as these are relatively small carriers, this is unlikely to have a material bearing on the analysis.  Also, for optical fibre and microwave subscriber connections, SingTel Optus only provided information on the number of buildings connected rather than the number of subscribers.  This is likely to understate the

number of end user services supported by optical fibre and microwave subscriber connections.

**Table 2: Types of local access networks (30 June 2004)**

| Network type | Carriers | Percentage |
|---|---|---|
| Copper | Alphalink (Australia), Central Coast Internet, iWireless, Linknet Communications, Telstra, TransACT[†], Victorian Rail Track | 87.20 |
| Optical fibre | AAPT, Amcom Telecommunications, Country Energy,  Integrated Community Networks, Ipera Communications, Macquarie Corporate Telecommunications, MCI WorldCom Australia, National Power Services, Nextgen Networks, Neighborhood Cable, PIPE Networks (formerly IX Services), Port of Brisbane Corporation, Powercor Australia Telecom, PowerTel, Primus Telecom, SingTel Optus, Swiftel Communications, Telstra, Victorian Rail Track | 0.60 |
| HFC | Broadcast Engineering Services, Ergon Energy, Neighborhood Cable, SingTel Optus, Telstra, Windytide (AUSTAR) | 11.86 |
| Microwave , LMDS, MMDS and fixed wireless | AAPT, Access Providers, Alphalink (Australia), Big Air Australia, Eastern Wireless, Etherwave Networks, Integrated Community Networks, Link Innovations, Linknet Communications, Neighborhood Cable, Norlink Communications, Northern Technology Solutions (formerly Arafura Connect), Nowires, OMNIconnect, Port of Brisbane Corporation, satellite-wireless.com, SingTel Optus, Southern Phone Company, Telstra, Unwired Australia | 0.21 |
| ISM & modified spread spectrum | Airnet Commercial Australia, iWireless | 0.00 |
| Satellite | Bareena Holdings, iPSTAR Australia, New Skies Networks, PanAmSat Asia Carrier Services, SingTel Optus, Telstra | 0.13 |
| **Total** | | **100.00** |

† The TransACT network is a hybrid copper/optical fibre network.

**Figure 2: Types of local access network (30 June 2004)**



☒ Copper

▦ Optical fibre

▨ HFC

■ Microwave, LMDS,
MMDS, fixed wireless,
ISM and modified
spread spectrum

▨ Satellite
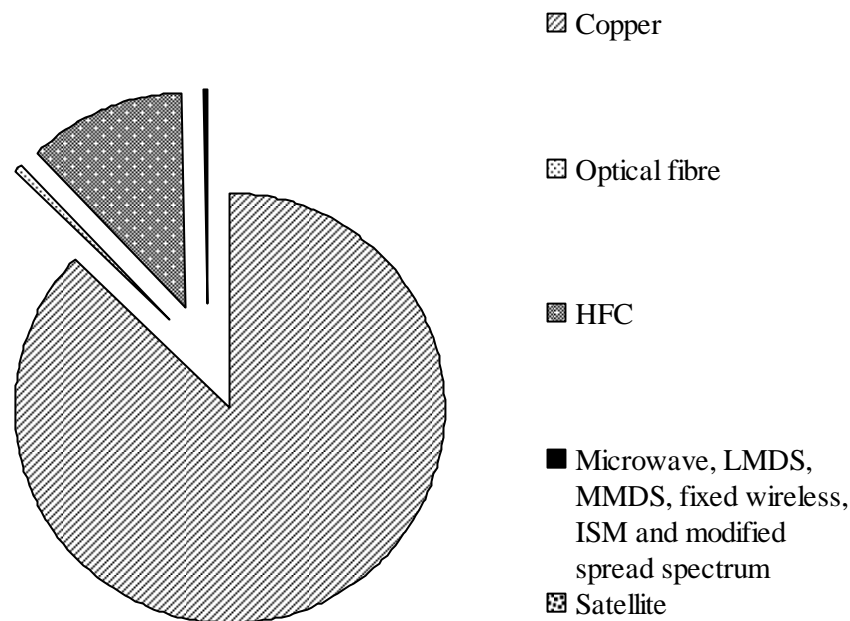
From the information in Table 2 and Figure 2, comparisons can be made concerning the relative importance of particular local access media in service delivery.  Particularly, it is worth noting the significance of HFC for local access networks.  Nevertheless, despite the emergence of alternative forms of subscriber access, copper wire is still the predominant method of residential customer access.  However, optical fibre systems serving large buildings frequently support multiple services.  Consequently the basis for this comparison results in a bias toward residential services as most telecommunications services to CBD and large business premises are provided on optical fibre.

### 2.2.2.    Carriers

Table 3 and Figure 3 present the volume of wholesale and retail subscriber connections on a carrier-by-carrier basis and thus provide information about the level of competition for the provision of local access services.

As noted in section 2.2.1, not all carriers provided information on subscriber connections.  Consequently, there are a number of blank entries in Table 3.

From this information, it can be seen that Telstra continues to hold the majority of local access connections (92.94 per cent), with SingTel Optus being the main alternative carrier (6.54 per cent of connections).  Together they hold approximately 99 per cent of subscriber connections, confirming the widely-held view that there is a high level of concentration for the provision of local access services and that the newer carriers are

yet to make significant in-roads in eroding Telstra's market share, particularly in residential segments.

That said, caution should be exercised in using this information to draw conclusions about carriers' shares of particular downstream markets. This is because the subscriber connections are used to supply services in different downstream markets — local telephony, pay-TV and high bandwidth carriage services (broadband) — and accordingly, the relative share of connections held by carriers in each of these markets will differ.

Also, provision of customer access is a wholesale activity. Market shares at the retail level may differ because some carriers use the networks of other carriers to supply services to their customers. For example, Windytide (AUSTAR) uses the SingTel Optus satellite network to provide pay-TV services to its customers.

Moreover, the information in Table 3 is presented on a national basis and this may dilute the shares of other carriers whose networks provide an important source of competition within particular geographic foci. For instance, Alphalink (Australia), which accounts for less than 1 per cent of connections on a national basis, targets the CBD, metropolitan and provincial locations of Melbourne, where it has a subscriber base (approximately 30 000 connections) that is significantly larger than any carrier in these areas, with the exception of SingTel Optus and Telstra. Similarly, Windytide (AUSTAR), has a substantial subscriber base in the areas of Darwin and rural Australia (and an even larger customer base when its pay-TV customers supplied using the SingTel Optus satellite network are included). Section 2.3 provides further information about customer connections in particular geographic regions.

**Figure 3: Local access network connections for each carrier (30 June 2004)**
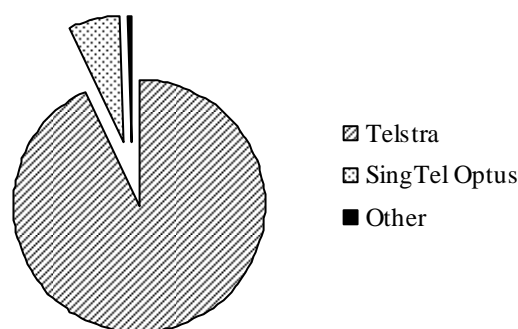
**Table 3: Type of local access network connections for each carrier (30 June 2004)**

| Carrier | Copper | Optical fibre | HFC | Microwave, LMDS, MMDS & fixed wireless | ISM & modified spread spectrum | Satellite |
|---|---|---|---|---|---|---|
| AAPT | | ✓ | | ✓ | | |
| Access Providers | | | | ✓ | | |
| Alphalink (Australia) | ✓ | | | ✓ | | |
| Amcom Telecommunications | | ✓ | | | | |
| Bareena Holdings | | | | | | ✓ |
| Big Air Australia | | | | ✓ | | |
| Broadcast Engineering Services | | | ✓ | | | |
| Central Coast Internet | ✓ | | | | | |
| Country Energy | | ✓ | | | | |
| Eastern Wireless | | | | ✓ | | |
| Ergon Energy | | ✓ | | | | |
| Etherwave Networks | | | | ✓ | | |
| Integrated Community Networks | | ✓ | | ✓ | | |
| Ipera Communications | | ✓ | | | | |
| iPSTAR Australia | | | | | | ✓ |
| iWireless | ✓ | | | | ✓ | |
| Link Innovations | | | | ✓ | | |

**Table 3 cont.**

| Carrier | Copper | Optical fibre | HFC | Microwave, LMDS, MMDS & fixed wireless | ISM & modified spread spectrum | Satellite |
|---|---|---|---|---|---|---|
| Linknet Communications | ✓ | | | ✓ | | |
| Macquarie Corporate Telecommunications | | ✓ | | | | |
| MCI WorldCom Australia | | ✓ | | | | |
| National Power Services | | ✓ | | | | |
| Neighborhood Cable | | ✓ | ✓ | ✓ | | |
| Nextgen Networks | | ✓ | | | | |
| New Skies Networks | | | | | | ✓ |
| Norlink Communications | | | | ✓ | | |
| Northern Technological Solutions | | | | ✓ | | |
| Nowires | | | | ✓ | | |
| OMNIconnect | | | | ✓ | | |
| PanAmSat Asia Carrier Services | | | | | | ✓ |
| PIPE Networks (formerly IX Services) | | ✓ | | | | |
| Port of Brisbane Corporation | | ✓ | | ✓ | | |
| Powercor Australia Telecom | | ✓ | | | | |

**Table 3 cont.**

| Carrier | Copper | Optical fibre | HFC | Microwave, LMDS, MMDS & fixed wireless | ISM & modified spread spectrum | Satellite |
|---|---|---|---|---|---|---|
| PowerTel | | ✓ | | | | |
| Primus Telecom | | ✓ | | | | |
| satellite-wireless.com | | | | ✓ | | |
| SingTel Optus | | ✓ | ✓ | ✓ | | ✓ |
| Southern Phone Company | | | | ✓ | | |
| Swiftel Communications | | ✓ | | | | |
| Telstra | ✓ | ✓ | ✓ | ✓ | | ✓ |
| TransACT | ✓ | | | | | |
| Unwired Australia | | | | ✓ | | |
| Victorian Rail Track | ✓ | | | | | |
| Windytide (AUSTAR) | | | ✓ | | | |

## 2.3. Geographic coverage

The Commission asked carriers to describe the geographical location of their networks using a rudimentary classification system — CBD, metropolitan, provincial and rural/remote — and provide subscriber numbers for each category. Most, but not all, carriers were able to do this and accordingly it has been necessary to aggregate some information (e.g. CBD and metropolitan subscriber connections). Moreover, for the purposes of the analysis, it was necessary to make certain assumptions about the geographic distribution of subscribers due to the lack of information disaggregation. Where relevant, these are explained in the following sections.

### 2.3.1. CBD and metropolitan areas

Table 4 presents information about the geographic location of local access networks in CBD and metropolitan areas.

Telstra did not geographically disaggregate the number of optical fibre connections. Given that it is most likely these connections were used to supply services to medium-large businesses, it has been assumed that all of the optical fibre connections in Telstra's local access network are within CBD and metropolitan areas. Moreover, Telstra stated that it operated a fixed wireless network in metropolitan, provincial and rural/remote areas but did not provide the total number of subscribers or a geographic breakdown.

Also, SingTel Optus did not fully geographically disaggregate the number of microwave links; it has been assumed that all of the microwave links in SingTel Optus' local access network are within CBD and metropolitan areas.

From the information in Table 4 it can be seen that the cities of Sydney, Melbourne, Brisbane, Adelaide and Perth continue to be best served by competitive local access network infrastructure. For instance, 13 carriers in Melbourne and Sydney have deployed local access networks. Telstra and SingTel Optus nevertheless remain as the major suppliers, together comprising approximately 99 per cent of subscriber connections although, in Sydney and Melbourne CBD areas.

It was unfortunate that the information received by the Commission was not sufficiently disaggregated so that CBD areas could be analysed separately from metropolitan areas. In this regard, it would have been particularly illuminating to examine whether differences in competitive forces in CBD and metropolitan areas are reflected in a lower level of concentration within CBD areas. Previously, the Commission has examined the number of buildings connected by Telstra and its competitors using optical fibre and noted Telstra's competitors have wired about 45 per cent of the buildings served by Telstra.[6] However, as also noted at that time, it is

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[6]   Although this information did not relate specifically to CBD areas most fibre connections are assumed to be in these areas. See Australian Competition and Consumer Commission, *Future scope of the Local Carriage Service — Final Decision,* July 2002, p. 25.

subscriber numbers rather than buildings connected which provide a better indication of market concentration.

### 2.3.2. Provincial areas

Table 5 presents information about the geographic location of local access networks in provincial areas. This includes major regional centres such as Wollongong and Newcastle in New South Wales, and Geelong, Bendigo, Mildura and Ballarat in Victoria.

While several carriers have deployed local access network infrastructure in New South Wales and Victoria, Telstra and SingTel Optus account for the majority of subscriber connections. In these areas, AAPT , Neighborhood Cable, Soul Pattinson Telecommunications and PowerTel offer the prospect of an alternative source of supply, particularly as they continue to develop their provincial networks.

### 2.3.3. Rural and remote areas

Table 6 presents information about the geographic location of local access networks in rural and remote areas. Once again, it is seen that Telstra and SingTel Optus hold the majority of subscriber connections.

**Table 4: Local access networks in CBD and metropolitan areas (30 June 2004)**

| Carrier | Sydney | Melbourne | Brisbane | Adelaide | Perth | Canberra | Hobart | Darwin |
|---|---|---|---|---|---|---|---|---|
| AAPT | O/M | O/M | O/M | O/M | O/M | O | | |
| Access Providers | | M | | | | | | |
| Alphalink (Australia) | | C/M | | | | | | |
| Amcom Telecommunications | | | | O | O | | | O |
| Bareena Holdings | S | S | S | S | S | S | S | S |
| Big Air Australia | M | | | | | | | |
| Broadcast Engineering Services | | | | | H | | | |
| Eastern Wireless | | M | | | | | | |
| IWireless | | | | | C/M | | | |
| Link Innovations | M | M | M | | | | | |
| Macquarie Corporate Telecommunications | O | O | | | | | | |
| MCI WorldCom | O | O | | | | | | |
| National Power Services | | O | | | O | | | |
| Nextgen Networks | O | O | O | O | O | O | | |
| New Skies Networks | S | S | S | S | S | S | S | S |
| Northern Technological Solutions | | | | | | | | M |
| OMNIconnect | | M | | | | | | |

**Table 4: cont.**

| Carrier | Sydney | Melbourne | Brisbane | Adelaide | Perth | Canberra | Hobart | Darwin |
|---|---|---|---|---|---|---|---|---|
| PanAmSat Asia Carrier Services | S | S | S | S | S | S | S | S |
| PIPE Networks (formerly IX Services) | O | | O | O | | | O | |
| Powercor Australia Telecom | | O | | | | | | |
| PowerTel | O | O | O | | | O | | |
| Primus Telecom | O | O | O | O | O | | | |
| Satellite-wireless.com | | | M | | | | | |
| SingTel Optus | O/H/M/S | O/H/M/S | O/H/S | O/M/S | O/M/S | O/M/S | O/S | O/S |
| Swiftel Communications | | | | | O | | | |
| Telstra | C/O/H/M/S | C/O/H/M/S | C/O/H/M/S | C/O/H/M/S | C/O/H/M/S | C/O/M/S | C/O/M/S | C/O/M/S |
| TransACT | | | | | | C | | |
| Unwired Australia | M | | | | | | | |
| Victorian Rail Track | | C/O | | | | | | |
| Windytide (AUSTAR) | | | | | | | | H |
| **Total** | | | | | | | | |

C = copper; O = optical  fibre; H = HFC; M = microwave, LMDS, MMDS, ISM and modified spread spectrum, and fixed wireless; S = satellite

**Table 5: Local access networks in provincial areas (30 June 2004)**

| Carrier | New South Wales | Victoria | Queensland | South Australia | Western Australia | Australian Capital Territory | Tasmania | Northern Territory |
|---|---|---|---|---|---|---|---|---|
| AAPT | M | O/M | O | | | | | |
| Alphalink (Australia) | | C | | | | | | |
| Bareena Holdings | S | S | S | S | S | S | S | S |
| Broadcast Engineering Services | | | | | H | | | |
| Central Coast Internet | C | | | | | | | |
| Country Energy | O | | | | | | | |
| Ergon Energy | | | O | | | | | |
| Ethernet Networks | M | | | | | | | |
| Integrated Community Networks | | | | | | | O/M | |
| Ipera Communications | O/M | | | | | | | |
| Link Innovations | C/M | M | | | | | | |
| Linknet Communications | C | | | | | | | |
| National Power Services | | | | | | | O | |
| Neighborhood Cable | | O/H/M | | | | | | |
| Nextgen Networks | O | | | | | | | |
| New Skies Networks | S | S | S | S | S | S | S | S |

**Table 5: cont.**

| Carrier | New South Wales | Victoria | Queensland | South Australia | Western Australia | Australian Capital Territory | Tasmania | Northern Territory |
|---|---|---|---|---|---|---|---|---|
| Norlink Communications | M | | | | | | | |
| Northern Technological Solutions | | | | | | | | M |
| Nowires | M | | | | | | | |
| OMNIconnect | | M | | | | | | |
| PanAmSat Asia Carrier Services | S | S | S | S | S | S | S | S |
| Port of Brisbane Corporation | | | O/M | | | | | |
| Powercor Australia Telecom | | O | | | | | | |
| PowerTel | O | | O | | | | | |
| SingTel Optus | M/S | M/S | S | M/S | M/S | M/S | S | S |
| Telstra | C/O/M/S | C/O/M/S | C/O/M/S | C/O/M/S | C/O/M/S | C/O/M/S | C/O/M/S | C/O/M/S |
| Victorian Rail Track | | C/O | | | | | | |
| **Total** | | | | | | | | |

C = copper; O = optical fibre; H = HFC; M = microwave, LMDS, MMDS, ISM and modified spread spectrum, and fixed wireless; S = satellite

**Table 6: Local access networks in rural and remote areas (30 June 2004)**

| Carrier | New South Wales | Victoria | Queensland | South Australia | Western Australia | Australian Capital Territory | Tasmania | Northern Territory |
|---|---|---|---|---|---|---|---|---|
| Alphalink (Australia) | C | | | | | | | |
| Bareena Holdings | S | S | S | S | S | S | S | S |
| Integrated Community Networks | | | | | | | M | |
| Linknet Communications | C/M | | | | | | | |
| New Skies Networks | S | S | S | S | S | S | S | S |
| Nowires | M | | | | | | | |
| OMNIconnect | | M | | | | | | |
| PanAmSat Asia Carrier Services | S | S | S | S | S | S | S | S |
| Satellite-wireless.com | | | M | | | | | |
| SingTel Optus | S | S | S | S | S | S | S | M/S |
| Southern Phone Company | | | | | | | | |
| Telstra | C/O/S | C/O/S | C/O/S | C/O/S | C/O/S | C/O/S | C/O/S | C/O/S |
| **Total** | | | | | | | | |

C = copper; O = optical fibre; H = HFC; M = microwave, LMDS, MMDS, ISM and modified spread spectrum, and fixed wireless; S = satellite

## 2.4.    Capacity

Information concerning local access network capacity was sought by the Commission. However, not all carriers were able to provide this information.  Also, it appeared that some carriers provided information on target levels of capacity rather than actual levels of capacity, thereby limiting the extent to which inter-carrier comparisons could be made.  That said, it appears that many new carriers have relatively low utilisation rates and thus relatively high levels of spare capacity.

## 2.5.    Third party access

Table 7 presents information on the extent to which carriers' networks are used by other service providers.

**Table 7: Local access network use by other service providers (2003-04)**

| Carrier | Network type | Capacity used by other service providers (%) |
|---|---|---|
| Access Providers | microwave | 10.0 |
| Amcom Telecommunications | optical fibre | <20.0 |
| Big Air | microwave | 10.0 |
| Country Energy | optical fibre | 95.0 |
| Ipera Communications | optical fibre | 10.0 |
| Link Innovations | microwave | 0.8 |
| Nextgen Networks | optical fibre | 100.0 |
| New Skies Networks | satellite | 20.0 |
| Norlink Communications | microwave | <5.0 |
| PanAmSat Asia Carrier Services | satellite | 100.0 |
| PIPE Networks (formerly IX Services) | optical fibre | 2.0 |
| PowerTel | optic fibre | 66.0 |
| Primus Telecom | optical fibre | <1.0 |
| SingTel Optus | satellite | 29.0 |
| Southern Phone Company | microwave | 7.0 |
| Swiftel Communications | optical fibre | 30.0 |
| Telstra | copper | 15.5 |
|  | satellite | 5.0 |

It is not clear that carriers have provided this information on a consistent basis and, accordingly, caution should be exercised in making comparisons between carriers.

For instance, Telstra based its estimate on the number of basic access lines sold to other service providers, thus providing information about the number of subscriber connections exclusively used by other service providers. That said, this did not include the number of lines used to supply ULLS or PAPL services to other service providers.

Other carriers did not specify the basis on which their estimates were prepared and consequently, it is not clear whether they were prepared on the basis of exclusive or non-exclusive use (e.g. for the purposes of terminating calls from other networks).

Nevertheless, Table 7 shows that many carriers enable competitors to use their local access networks in order to provide telecommunications services to end-users. In some cases, these arrangements are governed by the access provisions of Part XIC of the Trade Practices Act whereas, in others it appears that sufficient incentives exist for the parties to voluntarily negotiate arrangements without the need for regulatory intervention.

## 2.6. Investment

The Commission requested information about the value of local access network assets and investment undertaken over 2003-04. Unfortunately, the information concerning value of network assets was incomplete. Moreover, some carriers were unable to disaggregate valuations of local access network assets from total network assets.

Information about the level of local access network investment over 2003-04 was, however, generally provided and is presented in Table 8. Carriers invested $1.765 billion in their local access networks over this period, with carriers other than Telstra undertaking approximately one-third of this investment. In particular, significant investment occurred in relation to copper, optical fibre, HFC and satellite networks.

In some cases, the investment covers infrastructure other than local access networks and thus, the level of investment will be overstated to some degree. For instance, SingTel Optus was unable to disaggregate its satellite local access network investment from its satellite transmission route investment.

**Table 8: Investment in local access networks (2003-04)**

| Network type | Total ($m) |
|---|:---:|
| Copper | 600.8 |
| Optical fibre | 127.1 |
| HFC | 35.9 |
| Microwave, LMDS, MMDS and fixed wireless | 37.6 |
| ISM spread and modified spread spectrum | - |
| Satellite | 70.7 |
| **Total** | **872.1** |

† Investment in USD was converted to AUD using an average exchange rate for 2003-04 ($AUD = $0.7140 USD).

*Source:* RBA

The Commission also sought information about the level of investment planned for 2004-05 and this is summarised in Table 9. As is shown, both Telstra and other carriers plan to undertake modest levels of investment in relation to their copper, optical fibre and satellite networks. While this involves network expansion and deployment, there does not appear to be any large scale deployment planned. The Commission notes that the level of investment in local access networks is about 50 per cent lower than the level for 2001-02.[7] That said, it is possible that significant levels of excess capacity are constraining investment by the newer carriers.

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[7] ACCC, *Telecommunications Infrastructure in Australia 2002*, p. 20.

**Table 9: Planned local access network investment (2004-05)**

| Network type | Nature of investment |
| --- | --- |
| Copper | Ongoing network growth to meet new demand, and replacement of existing assets (Telstra). |
| | Relocation of AS router to Haymarket (Central Coast Internet). |
| | Network expansion to meet customer demand; market testing of Ethernet services to the customer up to 10 GB (TransACT Communications). |
| Optical fibre | Ongoing deployment of infrastructure to meet product demand (Telstra). |
| | Continue to expand coverage in metro areas of Brisbane, Sydney and Melbourne over existing HFC cables to provide IP/Ethernet services; new fibre cable infrastructure in Adelaide, Perth and regional areas of Victoria, NSW and Queensland; enhancement of capacity of existing fibre via the introduction of CWDM technologies in the Access Network; growth in CAN to meet customer demand (SingTel Optus). |
| | Expand Ethernet access platform and Metro LAN; improve diversity of major SDH Metro/Access fibre rings (AAPT). |
| | Continued expansion to meet product demand (Amcom Telecommunications). |
| | The regional fibre is being deployed (Federal initiative known as Twin Towns) and will be utilised by Soul Pattinson Telemedia to provide broadband services to health and education facilities. Scope exists for the fibre to be extended and enhanced to serve the requirements of additional users such as local councils and tertiary institutions (Country Energy). |
| | Possible network expansion in Blackwater, Dysart and Moranbah (Ergon Energy). |
| | Trialling data over powerline technology for tail circuits (Ipera Communications). |
| | Extension of fibre network to meet customer demand including the provision of fibre tails; provision of SDH muxes and core SDH equipment; deploy high/low capacity point to point Ethernet services; deploy switch Ethernet/MPLS platform for Metro Ethernet services – point to point and multipoint (Nextgen Networks). |
| | Investment in Brisbane and Sydney Metro (PIPE Networks). |
| | [c-i-c] (Powercor Australia). |
| | Continual fibre network expansion (PowerTel). |
| | Roll-out of new cable to Telstra exchanges for the delivery of transmission requirements for xDSL (Primus Telecom). |
| | Deployment of National Layer 2 Network (Swiftel Communications). |
| | Further expansion of fibre network to cover all metropolitan rail routes and resiliency links (Victorian Rail Track). |

**Table 9: cont.**

| | |
|---|---|
| HFC | Installation of cable modem routers (Telstra). |
| | Continuing roll-out of HFC network, roll-out of new FttX network (Broadcast Engineering Services). |
| | Major upgrade to digitise the cable network (Windytide). |
| Microwave, LMDS and MMDS | [c-i-c] (SingTel Optus). |
| | Relocation and rearrangement of existing LMDS nodes; expansion of SDH/Ethernet radio access applications (AAPT). |
| | Expansion into Brisbane and Adelaide (Access Providers). |
| | Installing new access points in areas of Melbourne where DSL is not available (Alphalink). |
| | 4 to 6 additional base stations (BigAir Australia). |
| | 3 additional base stations and significant investment in the core network (Etherwave Networks). |
| | Complete full coverage of Melbourne and Sydney by Nov 2005; complete CBD and Metro coverage of Brisbane by July 2005 (Link Innovations). |
| | Install wireless network access points to Goonellabah and Lismore NSW (Linknet Communications). |
| | Install new WiMAX compliant equipment to extend network and provide coverage to "blackspots" in the existing network (Norlink Communications). |
| | Expansion into other non-ADSL suburbs in other States (Northern Technology Solutions (formerly Arafura Connect). |
| | 2 additional base stations to provide increased rural coverage (Nowires). |
| | Extending network in Stawell and Halls Gap (OMNIconnect). |
| ISM and modified spread spectrum | Expansion into other metro areas; 10 additional base stations (iWireless). |
| Fixed wireless | Ongoing recovery of fixed radio access base stations and service reprovision via alternate technologies (Telstra). |
| | [c-i-c] (SingTel Optus). |
| | Ongoing expansion to meet customer demand (Unwired). |
| Satellite | Infrastructure upgrade to support additional satellite transponder (Telstra). |

# Chapter 3. ISDN and xDSL networks

## Overview

- Telstra is the main supplier of ISDN services, supplying approximately 93 per cent of services as at 30 June 2004.

- xDSL is a relatively new service, enabling high-speed carriage using copper lines. As at 30 June 2004, there were over 435 000 xDSL services in operation.

- Telstra was the main supplier of xDSL services. In addition to full service telecommunications carriers like SingTel Optus, Primus and AAPT, niche players provide an important source of competition.

- Carriers supplying xDSL services tend to be concentrated in CBD and metropolitan areas, particularly Sydney, Melbourne, Brisbane, Adelaide and Perth where there are at least nine carriers.

- While there has been some deployment of copper lines to supply xDSL services (primarily, TransACT in the Australian Capital Territory, and a network run by Victorian Rail Track in Victoria), most carriers use Telstra's copper lines to supply xDSL services.

- During 2003-04, approximately 42 per cent of xDSL services were provided by carriers other than Telstra. 3.58 per cent of total services were supplied using carriers' own networks, 32.17 per cent of total services were supplied using Telstra's wholesale xDSL service, 3.40 per cent of total services were supplied using Telstra's unconditioned local loop service and 2.53 per cent of total services were supplied using Telstra's line sharing service.

- During 2003-04, at least $142.3 million was invested in xDSL infrastructure.

## 3.1.    Technical issues

ISDN and xDSL[8] are digital technologies that enable the carriage of traffic along copper wires at high speeds. Converting the copper wire to a high speed circuit is achieved by attaching electronic equipment (line cards, modems) to each end of the copper wire. This enables the line to be used for a broader range of applications, in addition to basic telephony.

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[8]    xDSL is a collective term used to refer to ADSL, HDSL, SHDSL, and VDSL.

### 3.1.1. ISDN services

In Australia, ISDN services are supplied as either a "basic rate" service or a "primary rate" service. With the basic rate service, there are two 64 kbps channels which can be used for the transmission of voice and data traffic simultaneously. With the primary rate service, up to thirty 64 kbps channels are available.

ISDN services are used to carry voice, data and video traffic. Basic rate services are targeted at residential, small business, medium business and large business subscribers. Primary rate services are targeted at business subscribers (small, medium and large) as well as at wholesale customers (e.g. other carriers).

### 3.1.2. xDSL services

xDSL services are generally divided into two main categories — asymmetric and symmetric. Asymmetric DSL services provide relatively lower rates upstream but higher rates downstream. Symmetric DSL services provide identical data rates upstream and downstream. The speed at which traffic is carried is influenced by the length and quality of the copper wire — faster speeds are achievable over shorter distances.

There are two types of asymmetric DSL services — ADSL and VDSL. The main difference between them is the speed at which traffic is carried. ADSL is capable of a data-transfer speed of up to 8 Mbps downstream and up to 768 kbps upstream, over a distance of up to 2 kms, although in Australia the maximum downstream and upstream speeds are 1.5 Mbps and 256 kbps respectively.[9] VDSL is capable of a data-transfer speed of up to 52 Mbps downstream and up to 2.3 Mbps upstream, over a distance of 300 metres.

Also, there are two types of symmetric DSL services — HDSL and SHDSL. They differ in terms of the number of copper pairs required and the distances over which particular data-transfer speeds can be achieved. HDSL carries traffic using either one or two copper pairs. It can achieve a data-transfer speed of up to 2 Mbps over 2.4 kms or 1.5 Mbps over 2.7 km. SHDSL carries traffic using a single copper pair and is capable of delivering data-transfer speeds of up to 2.3 Mbps over 3 kms.

xDSL services are primarily used to carry voice and data traffic, although two carriers reported using the technology to carry video traffic. Carriers target these services at the full range of subscribers — residential, small business, medium business and large business, as well as wholesale customers.

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[9] Australian Competition and Consumer Commission, *Emerging market structures in the communications sector: a report to Senator Alston, Minister for Communications, Information Technology and the Arts*, June 2003, p. 35.

## 3.2. Network size

### 3.2.1. ISDN

Table 10 and Figure 4 present the volume of ISDN services in operation as at
30 June 2004.  To enable comparisons between carriers for both basic rate and primary
rate services, these services have been converted to line equivalents — basic rate
services are treated as equivalent to two lines and primary rate services are treated as
equivalent to 25 lines.[10]

Primus and PowerTel supplied ISDN services using both their own networks and
Telstra's ISDN.  Given that the information requested by the Commission covered
wholesale and retail ISDN services, this has resulted in a degree of "double counting".
That said, the Commission understands the volume of ISDN services supplied by
Telstra to these carriers is low, suggesting that the impact of any double counting is
likely to be immaterial.

**Table 10: ISDN services (30 June 2004)**

| ISDN rate | Carrier |
| --- | --- |
| Basic rate | Telstra |
| Primary rate | AAPT |
| | PowerTel |
| | Primus |
| | Telstra |
| | **Total** |

As at 30 June 2004, Telstra supplied approximately 93 per cent of ISDN services, as
shown in Figure 4, with AAPT being its nearest competitor.

---

[10]  Primary rate ISDN services provide up to thirty 64 kbps channels.  Telstra, the main supplier of
primary rate ISDN services, offers the services in bundles of ten, twenty or thirty channels.  The
comparison rate of 25 line equivalents broadly represents a weighted average of 25 channels per
primary rate service.

**Figure 4: ISDN services (30 June 2004)**



Legend:
- Telstra
- AAPT
- Primus
- PowerTel
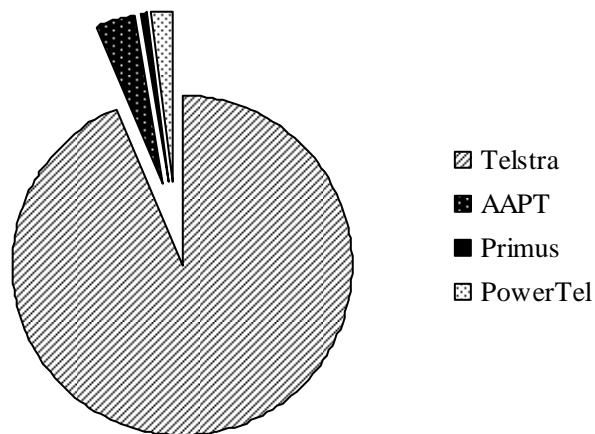
### 3.2.2.    xDSL

Table 11 presents information on types of xDSL services supplied by each carrier as at 30 June 2004.  At this time there were over 435,000 xDSL services in operation.

Telstra supplied the majority of xDSL services.  In addition to full service telecommunications carriers like SingTel Optus, Primus and AAPT, niche carriers provide an important source of competition for these services.  That said, many of the niche carriers supplied services using wholesale xDSL services acquired from Telstra, rather than using their own networks or the ULLS service (see section 3.4).  This is likely to limit the extent to which they are able to compete with Telstra in terms of price, bandwidth and service quality.

**Table 11: xDSL services (30 June 2004)**

| Carrier | ADSL | VDSL | HDSL | SHDSL |
|---|:---:|:---:|:---:|:---:|
| AAPT | ✓ | | | |
| Alphalink (Australia) | ✓ | | ✓ | |
| Amcom | ✓ | | | |
| Chariot Internet | ✓ | | ✓ | |
| Country Energy | ✓ | | | |
| Ipera Communications | ✓ | | | ✓ |
| PIPE Networks (formerly IX Services) | ✓ | | | |
| Powercor Australia Telecommunications | | | | ✓ |
| PowerTel | ✓ | | | ✓ |
| Primus Telecom | ✓ | | ✓ | ✓ |
| SingTel Optus | ✓ | | | |
| Swiftel Communications | ✓ | | ✓ | ✓ |
| Telstra | ✓ | | | |
| TransACT | | ✓ | | |
| Victorian Rail Track | | | ✓ | |
| Westnet | ✓ | | | |

## 3.3.    Geographic coverage

### 3.3.1.    ISDN

Telstra supplies basic rate ISDN services throughout Australia.  It also supplies primary rate ISDN services throughout CBD and metropolitan areas, as well as some provincial, rural and remote areas.

As at 30 June 2004, there were three other carriers supplying primary rate ISDN services throughout CBD and metropolitan areas, as shown in Table 12.  Two of these carriers also supply primary rate ISDN services in a limited number of provincial areas — see Table 13.  AAPT supplies services to subscribers in the Gold Coast, Newcastle, Gosford, Wollongong, Geelong and Bendigo.  PowerTel stated that it provides services in Newcastle and Gold Coast, although as at 30 June 2004 it did not report any customers in these areas.

### 3.3.2.    xDSL

The areas in which the suppliers of xDSL services operate are presented in Table 14 (CBD and metropolitan), Table 15 (provincial) and Table 16 (rural and remote). Information on CBD and metropolitan areas is considered together because the

majority of carriers operating in CBD locations also supplied xDSL services in metropolitan locations.

Not unexpectedly, it is the CBD and metropolitan areas in which carriers supplying xDSL services tend to be concentrated, particularly Sydney, Melbourne, Brisbane, Adelaide and Perth where there are at least nine suppliers of xDSL services. Unfortunately, Telstra did not provide geographically disaggregated information and accordingly, it was not possible to examine whether the increased level of competition within CBD and metropolitan areas was reflected in a reduced level of concentration within those areas.

**Table 12: ISDN services in CBD and metropolitan areas (30 June 2004)**

| Carrier | Sydney | Melbourne | Brisbane | Adelaide | Perth | Canberra | Hobart | Darwin |
|---|---|---|---|---|---|---|---|---|
| **Basic rate** | | | | | | | | |
| Telstra | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| **Primary rate** | | | | | | | | |
| AAPT | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | |
| PowerTel | ✓ | ✓ | ✓ | | | ✓ | | |
| Primus Telecom | | | | | | | | |
| Telstra | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| TransACT | | | | | | ✓ | | |

**Table 13: ISDN services in provincial areas (30 June 2004)**

| Carrier | New South Wales | Victoria | Queensland | South Australia | Western Australia | Australian Capital Territory | Tasmania | Northern Territory |
|---|---|---|---|---|---|---|---|---|
| **Basic rate** | | | | | | | | |
| Telstra | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| **Primary rate** | | | | | | | | |
| AAPT | ✓ | ✓ | ✓ | | | | | |
| PowerTel | ✓ | | ✓ | | | | | |
| Telstra | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

**Table 14: xDSL services in CBD and metropolitan areas (30 June 2004)**

| Carrier | Sydney | Melbourne | Brisbane | Adelaide | Perth | Canberra | Hobart | Darwin |
|---|---|---|---|---|---|---|---|---|
| AAPT | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | |
| Alphalink (Australia) | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Chariot Internet | ✓ | ✓ | ✓ | ✓ | | | | ✓ |
| Country Energy | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Ipera Communications | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| PIPE Networks (formerly IX Services) | | | ✓ | | | | | |
| PowerTel | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | |
| Primus Telecom | | | | | | | | |
| SingTel Optus | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Swiftel Communications | ✓ | ✓ | ✓ | ✓ | ✓ | | | |
| Telstra | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| TransACT | | | | | | ✓ | | |
| Victorian Rail Track | | ✓ | | | | | | |
| Westnet | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

**Table 15: xDSL services in provincial areas (30 June 2004)**

| Carrier | New South Wales | Victoria | Queensland | South Australia | Western Australia | Australian Capital Territory | Tasmania | Northern Territory |
|---|---|---|---|---|---|---|---|---|
| AAPT | ✓ | ✓ | | | | | | |
| Alphalink (Australia) | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Chariot Internet | ✓ | ✓ | ✓ | ✓ | | | | ✓ |
| Country Energy | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| PIPE Networks (formerly IX Services) | | | ✓ | | | | | |
| Powercor Australia | | ✓ | | | | | | |
| PowerTel | | | ✓ | | | | | |
| SingTel Optus | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | |
| Swiftel Communications | ✓ | ✓ | ✓ | ✓ | ✓ | | | |
| Telstra | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Westnet | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

**Table 16: xDSL services in rural and remote areas (30 June 2002)**

| Carrier | New South Wales | Victoria | Queensland | South Australia | Western Australia | Australian Capital Territory | Tasmania | Northern Territory |
|---|---|---|---|---|---|---|---|---|
| Alphalink Australia | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Chariot Internet | ✓ | ✓ | ✓ | ✓ | | | | ✓ |
| Country Energy | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Swiftel Communications | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Telstra | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Westnet | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

## 3.4.    Third party access

### 3.4.1.    ISDN

Telstra supplies ISDN services using its own network.

AAPT, Primus and PowerTel on the other hand, supply ISDN services using both their own local access networks and other carriers' networks, namely networks operated by Telstra and XYZed (a SingTel Optus subsidiary).  The Commission did not, however, receive comprehensive information on the extent to which these other carriers' networks are used.

### 3.4.2.    xDSL

xDSL services are supplied using a copper wire medium between subscriber premises and network nodes.  The incumbent carrier, Telstra, holds most of the copper lines in Australia, which it can use to supply these services.  Carriers other than Telstra, however, must either deploy their own copper lines or enter into arrangements with Telstra to use its lines.

Fundamentally, there are three types of arrangements which carriers can make with Telstra concerning the use of its lines.  These are described by reference to Figure 5.

**Figure 5: Methods of supply for xDSL services**
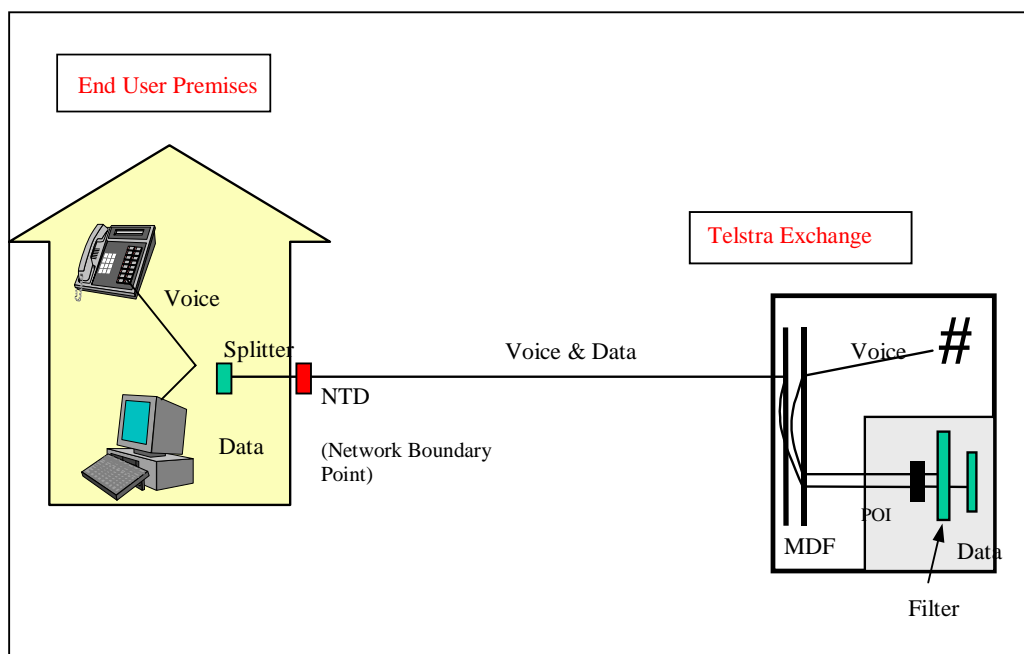


NTD = network termination device; MDF = main distribution frame;
POI = point of interconnection; # = local access switch

*Source*: Telstra

First, the carrier can acquire from Telstra a service known as the "unconditioned local loop service" (ULLS).[11]  This involves use of an unconditioned copper wire from the network boundary point at subscriber premises to the main distribution frame (MDF). The carrier then attaches a jumper lead from the MDF to its own equipment (which includes xDSL line cards) and thus supplies services directly to the subscriber.

Second, the carrier can enter into an arrangement with Telstra for line sharing whereby equipment at the exchange separates voice traffic from data traffic using a filter.  The carrier then carries the data traffic using its xDSL equipment and the voice traffic is handed over to Telstra.  This service was made available towards the end of 2001-02.

Third, the carrier can acquire a wholesale xDSL service from Telstra.  This involves Telstra installing xDSL equipment on the line and handing over all traffic from the line at a point of interconnection.  The carrier is then responsible for carriage of the traffic from that point.

Both the ULLS and the line sharing service are "declared" under Part XIC of the Trade Practices Act.  This means that, if the carrier acquiring the service and Telstra are unable to agree about the terms and conditions of supply, either of them can notify a dispute to the Commission.  The Commission then arbitrates and sets the terms and conditions of access.  The wholesale xDSL service is not declared.

Table 17 and Figure 6 present information about the manner in which xDSL services were supplied as at 30 June 2004.  They show that while Telstra used its own network to supply xDSL services, carriers other than Telstra supplied their xDSL services mainly through a mix of the ULLS, line sharing and wholesale xDSL services.

---

[11]  The ULLS is similar to the PAPL service that some carriers have, in the past, acquired from Telstra in order to supply HDSL services.  Where carriers have continued to use the PAPL service, this is treated as a ULLS in Table 17.

**Table 17: Method of supply for xDSL services (30 June 2004)**

| Carrier | Own lines | ULLS | Line sharing | Wholesale xDSL |
|---------|-----------|------|--------------|----------------|
| AAPT | | ✓ | | ✓ |
| Alphalink (Australia) | | | | ✓ |
| Amcom Telecommunications | ✓ | | | ✓ |
| Chariot Internet | | | | ✓ |
| Country Energy | | | | ✓ |
| Ipera Communications | | | | ✓ |
| PIPE Networks (formerly IX Services) | | | | ✓ |
| PowerCor Australia | | ✓ | | |
| PowerTel | | ✓ | ✓ | ✓ |
| Primus Telecom | | ✓ | ✓ | ✓ |
| SingTel Optus | | | | ✓ |
| Swiftel Communications | | | | ✓ |
| Telstra | ✓ | | | |
| TransACT | ✓ | ✓ | | |
| Victorian Rail Track | ✓ | | | |
| Westnet | | | | ✓ |

The majority of xDSL services were supplied by carriers using their own lines —
61.89 per cent. This is not surprising given that Telstra supplied the majority of those
services. The wholesale xDSL service was used to supply 32.17 per cent of xDSL
services, the ULLS was used to supply 3.40 per cent of services and line sharing was
used to supply 2.53 per cent. This is shown in Figure 6.

**Figure 6: Method of supply for xDSL services (30 June 2004)**



Legend:
- own lines
- ULLS
- line sharing service
- wholesale xDSL
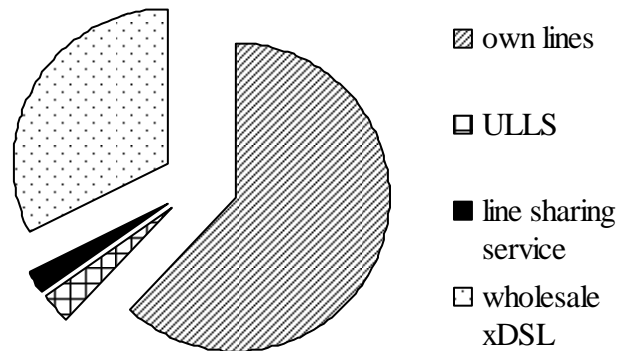
For carriers other than Telstra, 8.58 per cent of xDSL services were supplied using their own network, 77.17 per cent were supplied using Telstra's wholesale xDSL service, 6.08 per cent were supplied using Telstra's line sharing service and the remaining 8.17 per cent were supplied using Telstra's ULLS. This is shown in Figure 7.

**Figure 7: Method of supply for xDSL services by carriers other than Telstra (30 June 2004)**



Legend:
- own lines
- ULLS
- line sharing service
- wholesale xDSL
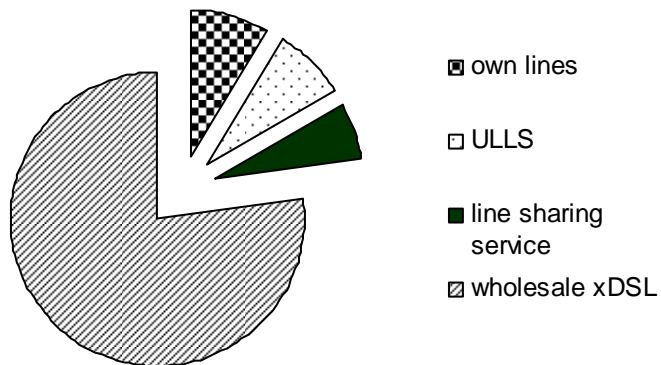
## 3.5.    Investment

Not all carriers provided information concerning their investment in ISDN and xDSL infrastructure. With respect to xDSL infrastructure, the carriers who did provide information valued their investment collectively at $772.7 million, of which

$142.3 million was undertaken during 2003-04.  The Commission notes that the level of investment in xDSL networks is about the same as the level for 2001-02.[12]

The Commission sought information about the level of investment planned for 2004-05.  This is summarised in Table 18.

**Table 18: Planned ISDN and xDSL investment (2004-05)**

| Carrier | Nature of investment |
|---|---|
| **ISDN** | Continue ports expansion project to meet customer needs (PowerTel). |
| | Roll-out of new equipment to Telstra exchanges nationally, 150 sites at this stage (Primus Telecom). |
| | Additional exchange ports and line cards augmentation to accommodate new growth (Telstra). |
| **xDSL** | Develop VOIP access; develop primary rate and managed network systems on DSL; develop IP – VPN; develop Layer 2 services (AAPT). |
| | Develop Layer 2 services (Alphalink). |
| | Substantially increase deployment of own infrastructure in Perth Metro (Amcom Telecommunications). |
| | Expand network capacity as required (Country Energy). |
| | Roll-out an additional 30 exchanges, taking total to 120 (PowerTel). |
| | Planning to roll-out 150 new DSLAM enabled sites in the next 12 months (Primus Telecom). |
| | [c-i-c] (SingTel Optus). |
| | Deployment of National Layer 2 network (Swiftel Communications). |
| | New architecture is being implemented to allow for ongoing major customer and traffic growth, and to lower the network cost with more efficient architecture for the customer/traffic spreads; deploy new exchange DSLAM technology, as well as smaller configuration DSLAMs for less dense customer sites (Telstra). |
| | Roll-out own DSLAM equipment in a further 3-6 exchanges (TransACT Communications). |
| | Establish an IP core network and an ADSL2 access network with services provided to only public transport franchise companies (Victoria Rail Track). |

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[12]  ACCC, *Telecommunications Infrastructure in Australia 2002*, p. 36.

# Chapter 4. Transmission networks

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## Overview

- Transmission networks use a range of media to carry traffic between local exchange areas — optical fibre, microwave and satellite.

- Competitive carriers have tended to focus on deploying transmission infrastructure along inter-capital city routes. As at 30 June 2004, seven carriers operated either an optical fibre or microwave network on the Melbourne to Sydney and Sydney to Brisbane routes, and four carriers operated an optical fibre on the Melbourne to Adelaide and Adelaide to Perth routes.

- Since the removal of declaration on the Melbourne to Adelaide to Perth routes, two new carriers have deployed optical fibre cable on these routes — Nextgen Networks and IP1 Australia, however, these carriers have recently been acquired by Leighton Contractors and Telstra, respectively.

- Telstra accounts for 58.81 per cent optical fibre transmission cable on inter-capital city routes. The remainder is held by SingTel Optus (19.02 per cent), Nextgen Networks (17.69 per cent), and PowerTel (4.48 per cent).

- During 2003-04, $348.7 million was invested by carriers in transmission infrastructure.

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## 4.1.    Technical issues

Transmission networks carry all forms of telecommunications requiring transport between local exchange areas and to customer premises. The media used for these networks includes:

- optical fibre cables — both terrestrial and submarine[13]

- microwave

- satellite.

Optical fibre cables are capable of carrying large volumes of traffic, depending on:

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[13]    Submarine only used for International transmission and from mainland Australia to Tasmania. This reference is not really appropriate in the context of local exchange areas.

- the number of fibre pairs in the cable

- the capacity of the multiplexers deployed on a wavelength carried by an optical fibre pair and

- the number of wavelengths enabled on each fibre pair by the installation of Dense Wave Division Multiplexing (DWDM) equipment.

Terrestrial cable can be laid either underground or carried above-ground on poles.

Microwave does not have the high capacity of optical fibre cable and must be deployed with direct "line of sight" between towers.  For smaller capacity requirements, however, it is generally more cost-effective to install microwave than optical fibre cable due to lower deployment cost and scalability.


## 4.2.    Network size

### 4.2.1.    Optical fibre

The Commission used the length of optical fibre cable sheath to compare the size of carriers' networks, and the results are presented in Table 19.  Other relevant metrics may have included network capacity and usage; however, information was not provided on a consistent basis in order for the Commission to use these metrics in assessing network size.

**Table 19: Optical fibre transmission routes (30 June 2004)**

| Carrier | Inter-capital city | | Other | |
| --- | --- | --- | --- | --- |
| | Route length (km) | % | Route length (km) | % |
| Nextgen Networks | 7 900 | 17.69 | | |
| Powercor Australia Telecom | | | 490 | 0.36 |
| PowerTel | 2 000 | 4.48 | | |
| SingTel Optus | 8 493 | 19.02 | | |
| Telstra | 26 262 | 58.81 | 132 726 | 97.91 |
| Victorian Rail Track | | | 520 | 0.38 |
| Other (Brisbane-Cairns) | | | 1 820 | 1.34 |
| **Total** | **44 655** | **100.00** | **135 556** | **100.00** |

Newer carriers have tended to focus on the deployment of inter-capital city transmission and accordingly, the information has been disaggregated along these lines — "inter-capital city" and "other".  The "other" routes include the links between regional areas and capital cities, as well as the "inter-exchange" network which links

local exchanges within particular areas (e.g. within capital cities).[14] Telstra is also understood to have optical fibre to its Mobile Network Base Stations.

Figure 8 presents the relative shares of inter-capital city routes attributable to each carrier.

**Figure 8: Inter-capital city optical fibre transmission routes (30 June 2004)**
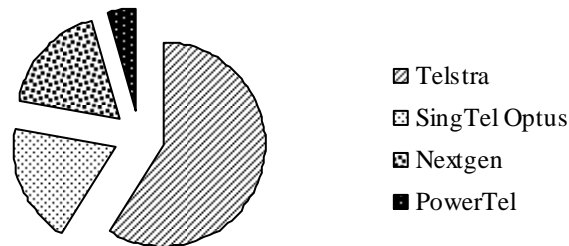


The Commission has previously expressed the view that each inter-capital city transmission route is a separate geographic market.[15] Accordingly, the fact that the Commission has aggregated these routes for the purposes of assessing national inter-capital city network size, should not be taken to suggest that the Commission now regards there as being a single national market for inter-capital city transmission. (Information on the carriers supplying particular inter-capital city routes is addressed in section 4.3.)

With respect to the "other" transmission routes, Telstra was unable to disaggregate transmission from fibre used in its local access network. Consequently, the length of optical fibre sheath for these routes is over-stated although, given the low volume of cable deployed by other carriers in these areas, this is unlikely to dramatically increase the proportion of total cable attributed to Telstra.

Also, an 1 820 km optical fibre route was constructed from Brisbane to Cairns by Reef Networks during 2001-02[16]. The Commission understands that SingTel Optus leased the entire capacity of the Reef Network and uses it for its purposes as well as to resell capacity to other carriers such as AAPT. As Reef Networks is not the holder of a carrier licence, this network was not captured by the survey responses but is noted in Table 19 for completeness.

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[14] The survey did not specifically ask carriers about their inter-exchange networks; however, it appears that most carriers included this in their responses. That said, it is unclear whether the Commission has fully captured all inter-exchange transmission links in responses to the survey.

[15] Australian Competition and Consumer Commission, *Domestic Transmission Capacity Service: a final report examining possible variation of the service declaration for the domestic transmission capacity service*, May 2001, p. 15.

[16] For further details, see http://www.governmentict.qld.gov.au/05_projects/reef.htm.

### 4.2.2. Microwave and satellite

Information received by the Commission regarding microwave and satellite transmission is set out in Table 20.

Unfortunately, the information received by the Commission in relation to microwave transmission was incomplete. In the infrastructure survey conducted by BIS Shrapnel for 2000-01, it was reported that Agile, Datafast, Soul Pattinson and Telecaster Communications each operated microwave transmission networks[17]. However, these carriers declined to respond to the Commission's survey for 2003-04. In addition, ntl Telecommunications did not provide a response. In order to ensure that these networks were not omitted, the Commission has used the information set out in the BIS Shrapnel report for Agile, Datafast, Soul Pattinson and Telecaster Communications, but notes that this information is as at 30 June 2001. For ntl Telecommunications, the Commission has used its 2002 survey response. Despite these shortcomings, however, it is clear that the microwave networks operated by newer carriers are relatively small in comparison to the Telstra network.

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[17] BIS Shrapnel, *Telecommunications Infrastructures in Australia 2001: A Research Report prepared for ACCC*, July 2001, pp.129-132.

**Table 20: Microwave and satellite transmission (30 June 2004)**

| Carrier | Microwave transmitters & base stations | Satellites |
|---|---|---|
| Agile | 10[†] | |
| Bareena Holdings (Quadrant Iridium) | | 66 |
| Country Energy | 5 | |
| Datafast | 29[†] | |
| Integrated Community Networks | 6 | |
| Linknet Communications | 5 | |
| ntl Telecommunications | 120* | |
| New Skies Networks | | 2 (Non-specific coverage of Australia) |
| OMNIconnect | 20 | |
| PanAmSat Asia Carrier Services | | 22 (5 provide full or partial coverage of Australia) |
| SingTel Optus | 5 | 4 |
| Soul Pattinson Telecommunications | >55[†] | |
| Telecaster Communications | 34[†] | |
| Telstra | 25 000 | [c-i-c] |

† information derived from BIS Shrapnel report for 30 June 2001

* ntl Telecommunications 2002 survey response

**Table 21: Inter-capital city transmission routes (30 June 2004)**

| Carrier | Sydney-Brisbane | Sydney-Melbourne | Sydney-Canberra | Melbourne-Canberra | Melbourne-Hobart | Melbourne-Adelaide | Adelaide-Perth | Adelaide-Darwin | Perth-Darwin |
|---|---|---|---|---|---|---|---|---|---|
| Bareena Holdings (Quadrant Iridium) | S | S | S | S | S | S | S | S | S |
| Nextgen Networks | O | O | O | O | | O | O | | |
| New Skies Networks | S | S | S | S | S | S | S | S | S |
| ntl Telecommunications[†] | M | M | | | | | | | |
| PanAmSat Asia Carrier Services | S | S | S | S | S | S | S | S | S |
| PowerTel | O | O | O | O | | | | | |
| SingTel Optus | O/S | O/S | O/S | O/S | S | O/S | O/S | S | S |
| Soul Pattinson Telecommunications[†] | M | M | M | M | | | | | |
| Telstra | O/M/S | O/M/S | O/M/S | O/M/S | O/M/S | O/M/S | O/M/S | O/M/S | O/M/S |

O = optical fibre; M = microwave; S = satellite
[†] 2002 survey response

## 4.3.	Geographic coverage

### 4.3.1.	Inter-capital city routes

Table 21 presents information on the number of carriers for each inter-capital city transmission route.

Since the Commission's last infrastructure report in 2002, there has been no new deployment of transmission infrastructure on inter-capital city routes. Moreover, the Commission notes that IP1 Australia's network (Melbourne – Adelaide and Adelaide – Perth) has been acquired by Telstra and Nextgen Networks has recently been acquired by Leighton Contractors.

### 4.3.2.	Other routes

Table 22 summarises the transmission routes operated by carriers to destinations outside of the capital cities. Telstra is, overwhelmingly, the main provider of optical fibre transmission routes in these areas. While there are a number of carriers using microwave transmission routes, except for Soul Pattinson these tend to be discrete networks providing only a limited degree of competition. Soul Pattinson Telecommunications operates a microwave transmission network with connections to many provincial centres throughout eastern Australia.

**Table 22: Transmission routes outside capital cities (30 June 2004)**

| Carrier | Medium | Route |
|---|---|---|
| Bareena Holdings (Quadrant Iridium) | Satellite | All of Australia. |
| Country Energy | Microwave | Central-west New South Wales |
| Integrated Community Networks | Microwave | Northern Tasmania |
| Linknet Communications | Microwave | Mullumbimby-Byron Bay and Mullumbimby-Coorabel |
| Nextgen Networks | Optical fibre | Wollongong-Sydney-Newcastle |
| New Skies Networks | Satellite | All of Australia. |
| OMNIconnect | Microwave | Regional Victoria. |
| PanAmSat Asia Carrier Services | Satellite | All of Australia. |
| Pivotel | Satellite | All of Australia. |
| Powercor Australia Telecom | Optical fibre | Melbourne-Geelong-Ballarat-Bendigo-Melbourne. |
| PowerTel | Optical fibre | Sydney-Newcastle-Brisbane. |
| SingTel Optus | Optical fibre | Connections to many regional centres along its inter-capital optical fibre networks. |
| | Microwave | Hobart-Launceston. |
| | Satellite | All of Australia. |
| Soul Pattinson Telecommunications* | Microwave | Eastern Australia. |
| Telstra | Optical fibre | Regional areas in all States and Territories. |
| | Microwave | Regional areas in all States and Territories. |
| | Satellite | Remote mainland areas and islands (e.g. Lord Howe, Christmas and Cocos Islands) |
| Victorian Rail Track | Optical fibre | Regional Victoria |

* Soul Pattinson 2002 survey response

## 4.4.    Third party access

During its review of the declaration for transmission capacity services, the Commission found that access third party was better on certain routes than on others.  The Commission therefore concluded that the scope of the transmission capacity service declaration should be amended to exclude a nominated list of capital-regional routes.[18]

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[18]    Australian Competition and Consumer Commission, *Review of the declaration for the domestic transmission capacity service: Final Report*, April 2004.

Table 23 presents the level of transmission network capacity used by other carriers and service providers. In most cases, the Commission only received aggregated information for all routes and so it was not possible to present the level of capacity used by service providers on particular routes. Also, not all carriers operating transmission routes responded to this question. Nevertheless, the available information does indicate a moderate level of use by service providers of carriers' transmission networks.

**Table 23: Transmission use by other service providers (2003-04)**

| Carrier | Network type | Capacity used by other service providers (%) |
|---------|--------------|-----------------------------------------------|
| Nextgen Networks | Optical fibre | 97.0 |
| PanAmSat Asia Carrier Services | Satellite | 100.0 |
| Pivotel | Satellite | [c-i-c] |
| Powercor Australia | Optical fibre | [c-i-c] |
| PowerTel | Optical fibre | 66.0 |
| SingTel Optus | Optical fibre | [c-i-c] |
| | Satellite | 29.0 |
| Telstra | Optical fibre | [c-i-c] |
| | Satellite | 5.0 |

## 4.5.    Investment

Table 24 presents the level of investment in transmission infrastructure during 2003-04. Not all carriers were able to disaggregate their investment in transmission infrastructure from the investment in local access network infrastructure. Where the investment covered both transmission and local access network infrastructure, this is presented in Table 8. To avoid double-counting, the investment is not replicated in Table 25 and consequently, the investment in transmission infrastructure may be understated.

**Table 24: Investment in transmission routes (2003-04)**

| Network type | Total ($m) |
|--------------|------------|
| Optical fibre | 222.2[†] |
| Microwave | 61.1[†] |
| Satellite | 65.4[†] |
| **Total** | **348.7[†]** |

† Investment by some carriers is aggregated with local access network investment, presented in Table 8.

The Commission notes that the level of investment in transmission networks is about 50 per cent lower than the level for 2001-02.[19]

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[19]    ACCC, *Telecommunications Infrastructure in Australia 2002*, p. 46.

The Commission also asked carriers about investment planned for 2004-05 and the information received is presented in Table 25.

**Table 25: Planned transmission investment (2004-05)**

| Carrier | Nature of investment |
|---------|---------------------|
| Linknet Communications | Develop data backhaul service from Lismore to Byron Bay via Goonellabah. |
| OMNIconnect | Upgrade and extend network trunk to Stawell and Halls Gap. |
| SingTel Optus | Procurement of additional satellites to meet demand for capacity. |
| Telstra | Completion of Jabira – Nhulunby, NT SDH radio system. |
| | Possible upgrade of Flinders Island system to SDH. |
| | Upgrade of small number of 34Mbit/s system to SDH. |
| | Some additional links and capacity requirements for mobiles. |
| | GSM network extension to Christmas Island. |

# Chapter 5. Mobile networks

## Overview

- As at 30 June 2004, four carriers operated second generation cellular mobile networks in Australia — Telstra, SingTel Optus, Vodafone and Hutchison. Services were provided using either GSM or CDMA technology. One carrier operated a third generation (3G) network in Australia — Hutchison. Services were provided using W-CDMA technology.

- Telstra operated GSM and CDMA networks, with 46.49 per cent of mobile subscribers connected to these networks. SingTel Optus and Vodafone each operated GSM networks and accounted for 35.01 and 14.79 per cent of mobile subscribers respectively. Hutchison operated a CDMA and a 3G network, connecting 3.70 per cent of mobile subscribers.

- The Telstra, SingTel Optus and Vodafone networks provided national coverage. Hutchison operated a network in Sydney and Melbourne and achieved national coverage through roaming arrangements with Telstra (CDMA) and Vodafone (GSM).

- During 2003-04, mobile carriers invested $1.1 billion in their GSM, CDMA and W-CDMA networks and all had plans for significant network expansion or upgrade beyond this period.

## 5.1. Technical issues

Mobile networks enable subscribers to initiate and receive calls by an individual handset at any place in which the network operates. In Australia, there are two types of mobile network — satellite and terrestrial-based cellular networks, with the latter accounting for the vast majority of subscribers.

### 5.1.1. Satellite mobile networks

Satellite networks provide ubiquitous coverage across large areas and have the technical potential for widespread use in a country like Australia with large, sparsely populated areas. However, to date, satellite networks remain a high cost operation and tend to use larger and heavier handsets compared with their terrestrial counterparts. People living and travelling in areas of Australia not serviced by terrestrial networks are able to access five satellite mobile networks — SingTel Optus (MobileSat), Bareena Holdings (Quadrant Iridium), Globalstar, Inmarsat and Pivotel.

While some respondents provided information about these services, they were intended to be outside the scope of the Commission's survey for 2003-04.

### 5.1.2. Terrestrial-based mobile networks

Terrestrial-based networks provide wireless communications through the use of cellular technology. The cellular system divides a geographical area into cells, each cell having a base station that consists of a tower and radio equipment. Base stations are coordinated through a mobile telephone switching centre, such that when the user moves from one cell to another, a hand-over occurs, switching the user's phone to a new cell. This allows the user to remain mobile between cells.

Broadly speaking, cellular networks are categorised into generations. The first generation of mobile networks (the AMPS network) has been phased out and services are now provided using second and third generation networks. During 2003-04, mobile services were provided via second and third generation networks using GSM, CDMA and 3G (W-CDMA) technology. Other third generation networks were being deployed.

All mobile carriers target residential, small business, medium business and large business, as well as wholesale customers.

#### *Second generation mobile networks*

GSM (Global System for Mobile) is a second generation mobile phone technology based on time division multiple access. Time division multiple access is a digital technique used to increase the intensity of spectrum use by splitting a single channel (allowing one subscriber) into eight time slots (each supporting one subscriber). GSM networks multiplex signals together over a transmission frequency.

CDMA (Code Division Multiple Access) is another second generation mobile phone technology. It uses a technology that creates multiple channels within a single bandwidth. Spread spectrum techniques transmit coded signals across several channels, having the effect of using a bandwidth much larger than the original signal. Each signal is uniquely coded such that many signals can occupy the same spectrum.

These networks are used to carry voice, data and text traffic. Recent network upgrades also enable the carriage of multi-media message services such as digital images.

#### *Third generation mobile networks*

Third-generation (3G) phone networks are high capacity digital networks that combine mobile voice services with high-speed internet-based services. 3G networks are based on broadband technology, whereas 2G networks are based on narrowband technology. The widening of the bandwidth will enable full broadband services such as voice, internet and real time video, operating on terrestrial and satellite-based networks.

W-CDMA(wideband code division multiple access) is a third generation mobile phone technology. It uses wideband digital radio communications to convey multimedia, video, data and voice communications at up to 2 Mbit/s for local area access or 384 kbit/s for wide area access.

1xRTT (single carrier radio transmission technology) is another third generation technology.  It is based on the CDMA platform and is capable of data rates up to 144kbit/s.

*Broadband wireless access networks*

Broadband wireless access means the radio connection of an end-user to a core PSTN, ISDN, Internet or local/wide area network that is capable of supporting higher data rate services.  The connection may be made by mobile or fixed point-to-point means.

## 5.2.     Network size

As at 30 June 2004, four carriers operated mobile networks throughout Australia.

- Telstra, the incumbent player since the first mobile network launch in 1987, operated both GSM and CDMA networks.  Telstra began deploying 1xRTT in its CDMA network in Melbourne and Sydney in December 2002.

- SingTel Optus and Vodafone, which entered in 1993 when the mobile market was partially opened up to competition, operated GSM networks.

- Hutchison, which launched its network in Sydney and Melbourne in July 2000, operated a CDMA network.  In 2003, Hutchison launched its 3G (W-CDMA) network. The '3' network is operational in 5 capital cities (Sydney, Melbourne, Brisbane, Adelaide and Perth).

In March 2004, Personal Broadband launched its iBurst network[20] in Sydney.  The iBurst access network covers a large part of metropolitan Sydney and the Commission understands that expansion has begun with base stations deployed in Melbourne, Brisbane, Canberra and the Gold Coast.

Complementing these terrestrial networks are mobile satellite services provided by Globalstar, Inmarsat, Mobilesat and Iridium.  Globalstar is a wholly-owned subsidiary of Pivotel which operates a low earth orbit satellite constellation with national roaming for cellular networks for satellite/GSM dual-mode services and satellite/CDMA dual–mode services.  Globalstar uses the Vodafone Network for the GSM cellular component of its service and has a roaming agreement to enable its customers to roam onto Telstra's CDMA network.

There are a number of ways in which the size of networks can be compared — number of subscribers, volume of traffic (e.g. minutes of traffic), number of base stations and population coverage.  The Commission did not capture volume of traffic as part of the survey; however, results for these other metrics are presented in Table 26.

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[20]   This is a broadband wireless access network.

**Table 26: Mobile networks (30 June 2004)**

| Carrier | Network | Subscribers | % | Population coverage |
|---|---|---|---|---|
| Hutchison | CDMA | 386 400 | 2.28 | 96.0[†] |
| | 3G (W-CDMA) | 240 000 | 1.42 | 92.0* |
| Personal Broadband | iBurst+ | 0 | 0.00 | [c-i-c] |
| Pivotel | Satellite/GSM & CDMA | 20 000 | 0.12 | 100.0 |
| SingTel Optus | GSM | 5 920 000 | 34.97 | 96.0 |
| | 3G (Trial network) | 0 | 0.00 | 1.7 |
| Telstra | GSM | 6 742 000 | 39.83 | [c-i-c] |
| | CDMA | 1 119 000 | 6.61 | [c-i-c] |
| Vodafone | GSM | 2 500 000 | 14.77 | 92.7 |
| **Total** | | **16 907 400** | **100.00** | |

† Hutchison roams onto Telstra's CDMA network in order to achieve national coverage.

* Hutchison roams onto Vodafone's GSM network in order to achieve national coverage.

+ Broadband wireless access network.

It can be seen that using both subscriber numbers and base station numbers produces broadly similar results, as indicators of network size. Telstra operates the largest network, followed by SingTel Optus, Vodafone and Hutchison.

**Figure 9: Mobile networks (30 June 2004)**

**Subscribers**



- Telstra
- SingTel Optus
- Vodafone
- Hutchison

**Base stations**



- Telstra
- SingTel Optus
- Vodafone
- Hutchison
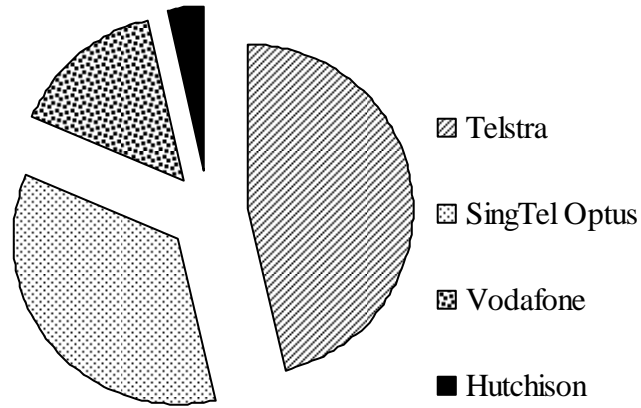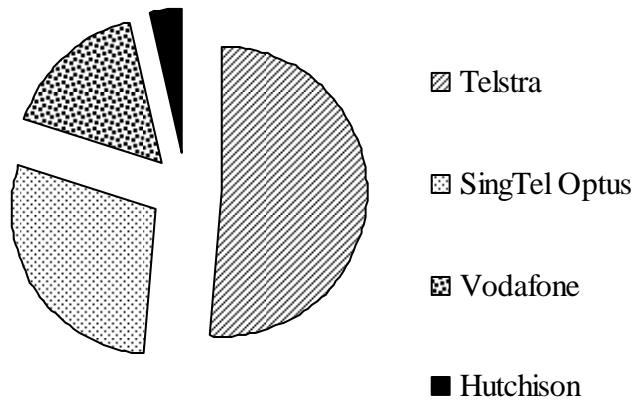
The relative share of subscribers held by each carrier can be regarded as a measure of market share held by that carrier, and thus provides an indication of the level of

concentration in the mobile services market.[21]  In this regard, Table 27 compares carriers' market shares over 1997-2004.[22]

**Table 27: Mobile carriers' market shares (1997-2004)**

| Carrier | 30 June 1997 (%) | 30 June 2000 (%) | 30 June 2001 (%) | 30 June 2002 (%) | 30 June 2003 (%) | 30 June 2004 (%) |
|---|---|---|---|---|---|---|
| Telstra | 59.0 | 48.2 | 46.0 | 47.4 | 45.8 | 45.7 |
| SingTel Optus | 32.0 | 33.4 | 34.0 | 33.8 | 34.0 | 35.4 |
| Vodafone | 9.0 | 18.3 | 18.8 | 16.9 | 18.1 | 15.8 |
| Hutchison | - | 0.1 | 1.2 | 1.9 | 2.1 | 3.1 |

*Source*: Australian Competition and Consumer Commission, *Mobile Services Review Mobile Terminating Access Service June 2004* , p. 73.

From Table 27 it can be seen that since 1997, SingTel Optus' and Hutchison's shares of the subscriber base has increased slightly whereas Vodafone's increased until 2003 with a slight decline in 2004, and Telstra's share has steadily declined.  That said, the total number of subscribers has also increased substantially over that period as shown in Table 28.

**Table 28: Mobile subscribers (1998-2004)**

| Year | AMPS | GSM | CDMA | 3G | Total |
|---|---|---|---|---|---|
| 30 June 1998[†] | 1 300000 | 4 000 000 | | | 5 300 000 |
| 30 June 1999[†] | 700 000 | 5 800 000 | | | 6 500 000 |
| 30 June 2000[†] | 100 000 | 8 200 000 | 300 000 | | 8 600 000 |
| 30 June 2001[†] | | 10 700 000 | 600 000 | | 11 300 000 |
| 30 June 2002 | | 12 225 241 | 840 110 | | 13 065 351 |
| 30 June 2003[†] | | 13 293 000 | 1 054 000 | 59 000 | 14 329 000 |
| 30 June 2004 | | 15 162 000 | 1 505 400 | 240 000 | 16 907 400 |

† *Source*: ABN-AMRO

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[21]  That said, carrier revenue might also be used to measure market shares — for a discussion of competition in the mobile services market, see Australian Competition and Consumer Commission, *Mobile Services Review: Mobile Terminating Access Service – Final Decision*, Chapter 4, June 2004.

[22]  The market shares in Table 27 as at 30 June 2002 differ slightly from those presented in Table 26. In the main, this is likely to be due to the different data sources used to compile the information.

## 5.3.     Coverage

All mobile network carriers except Hutchison operate networks throughout Australia — population coverage of the respective networks is set out in Table 26.  During 2003-04, Hutchison provided mobile services using its CDMA and 3G (W-CDMA) networks.  Hutchison achieved national coverage by roaming onto Telstra CDMA network to provide 2G services and onto Vodafone's GSM to provide 3G services when subscribers were outside its networks.

Table 29 presents information on the geographic location of mobile subscribers.  The only carriers that were able to supply this information to the Commission were Telstra and SingTel Optus. The Commission, however, understands that most subscribers are located in CBD and metropolitan areas.  That said, there was a significant difference between Telstra GSM and CDMA subscriber profile, with a greater proportion of CDMA subscribers being located in provincial, rural and remote areas when compared to GSM.

**Table 29: Geographic location of mobile subscribers (30 June 2004)**

| Carrier | CBD and metropolitan | | Provincial and rural remote | | Total |
|---|---|---|---|---|---|
| | subscribers | % | subscribers | % | |
| Telstra | | | | | |
| GSM | [c-i-c] | [c-i-c] | [c-i-c] | [c-i-c] | 5 162 000 |
| CDMA | [c-i-c] | [c-i-c] | [c-i-c] | [c-i-c] | 1 119 000 |
| SingTel Optus | [c-i-c] | [c-i-c] | [c-i-c] | [c-i-c] | 5 920 000 |
| Vodafone | N/A | N/A | N/A | N/A | 2 500 000 |
| Hutchison | | | | | |
| GSM | N/A | N/A | N/A | N/A | 386 400 |
| CDMA | N/A | N/A | N/A | N/A | 240 000 |

## 5.4.     Third party access

Mobile carriers enable other service providers to use their networks for the purpose of call termination, roaming and re-sale.

The Commission did not seek information on the extent to which networks were used for call termination.  With respect to roaming, the Commission understands that both Telstra and Vodafone enable other carriers to roam onto their networks.  It is aware for example, that Telstra has roaming arrangements enabling both Hutchison and Vodafone to roam onto its CDMA and GSM networks respectively in areas where they do not have coverage.

The Commission received limited information on the extent to which carriers supply mobile services to other service providers for resale, but understands that Telstra, SingTel Optus and Vodafone each supply mobile services via re-sellers.

## 5.5.    Investment

Table 30 provides estimates by carriers of the value of their networks as at
30 June 2004.  SingTel Optus, Vodafone and Hutchison prepared their estimates on the
basis of cumulative investment and Telstra declined to provide an estimate.  For
Telstra, the Commission used the Telstra regulatory accounting framework data for
2003-04.

**Table 30: Mobile network value (30 June 2004)**

| Carrier | Network | Network value ($m) |
|---------|---------|--------------------|
| Telstra | GSM | [c-i-c] |
| | CDMA | [c-i-c] |
| SingTel Optus | GSM | [c-i-c] |
| | 3G (Trial network) | [c-i-c] |
| Vodafone | GSM | [c-i-c] |
| Hutchison | CDMA | [c-i-c] |
| | 3G (W-CDMA) | |
| Personal Broadband | iBurst | [c-i-c] |
| Pivotel | Satellite/GSM & CDMA | [c-i-c] |
| **Total** | | **8 924** |

Table 31 presents carriers' estimates of their investment in mobile networks during
2003-04.

**Table 31: Mobile network investment (2003-04)**

| Carrier | Network | Investment ($m) |
|---------|---------|-----------------|
| Telstra | GSM | [c-i-c] |
| | CDMA | [c-i-c] |
| SingTel Optus | GSM | [c-i-c] |
| | 3G (Trial network) | [c-i-c] |
| Vodafone | GSM | [c-i-c] |
| Hutchison | CDMA | [c-i-c] |
| | 3G (W-CDMA) | [c-i-c] |
| Personal Broadband | iBurst | [c-i-c] |
| Pivotel | Satellite/GSM & CDMA | [c-i-c] |
| **Total** | | **1 112.8** |

The Commission notes that the level of investment in mobile networks is about 70 per
cent higher than the level for 2001-02.  Approximately 25 per cent of investment in
2003-04 was in 3G mobile networks.

The Commission also sought information about the level of planned investment for 2004-05. This is summarised in Table 32.

**Table 32: Planned mobile network investment (2004-05)**

| Carrier | Nature of investment |
|---|---|
| SingTel Optus | Expansion of GSM network capacity – additional base stations systems and network switching systems. |
| | Commence build of launch 3G trial network. |
| Telstra | Ongoing network development to provide additional coverage and depth on the GSM and CDMA networks. Also future development and expansion of a 3G radio access network. |
| Vodafone | Expansion of existing GSM network capacity. |
| | Commencement of investment in CDMA (3G) networks in all major capital cities in Australia. |
| Personal Broadband Australia | [c-i-c] |
| Pivotel | [c-i-c] |

# Chapter 6. Conclusions

During 2003-04, more than $2.5 billion was invested in telecommunications infrastructure. Investment in mobile network infrastructure accounted for almost half of this amount (44 per cent), followed by local access networks (35 per cent), transmission networks (14 per cent), xDSL services (6 per cent) and ISDN services (2 per cent).

Of the $872.1 million invested in local access network infrastructure over 2003-04, approximately one-fifth was invested by carriers other than Telstra. That said, these carriers are yet to make significant inroads into eroding Telstra's subscriber base which accounted for 92.94 per cent of subscriber connections across all local access network types as at 30 June 2004. Collectively, Telstra and SingTel Optus held approximately 99 per cent of all subscriber connections.

While many of the newer carriers have deployed local access networks, particularly in CBD and metropolitan areas, most have relatively small networks in terms of number of subscriber connections. It could possibly be concluded that as a result of previous investment activity, high levels of excess capacity on these networks are constraining ongoing investment by the newer carriers.

In relation to mobile networks, strong investment by all carriers continues to take place in mobile networks, with carriers investing $1.1 billion over 2003-04 in their GSM, CDMA and W-CDMA networks. Market shares remained relatively stable (although SingTel Optus and Hutchison increased their shares of the market, mainly at the expense of Vodafone) and the number of subscribers grew to 16.9 million.

Investments in relation to transmission capacity totalled $348.7 million in 2003-04. It is noted that during 2003-04 there were six carriers supplying optical fibre or microwave transmission capacity on the Sydney-Brisbane and Sydney-Melbourne routes and four carriers along the Melbourne-Adelaide and Adelaide-Perth routes. However, IP1 Australia and Nextgen Networks have been acquired Telstra and Leighton Contractors respectively. In regional areas, Telstra continues to dominate the supply of transmission capacity.

As at 30 June 2004, there were more than 435 000 xDSL services in operation. While Telstra is the main supplier of these services there are a large number of suppliers, particularly in the CBD and metropolitan areas of Sydney, Melbourne, Brisbane Adelaide and Perth. In this regard, niche carriers appear to be playing an important role, although it is noteworthy that many of them are supplying services using wholesale xDSL services acquired from Telstra. This is likely to limit the extent to which they are able to compete with Telstra in terms of price, bandwidth and service quality. Investment in xDSL infrastructure totalled at least $142 million in 2003-04.

The Commission believes reporting on telecommunications infrastructure to be a valuable exercise, not only for itself, but also in order to inform both Government and market participants more broadly. In this regard, it was disappointed that not all carriers were able to provide the requested information.

One area where this caused particular concern was in relation to the geographic distribution of local access networks, transmission networks and xDSL services. The inability of some carriers to provide separate subscriber information for CBD and metropolitan areas has limited the ability of the Commission to assess the manner in which competition is developing in these areas.

In a number of other cases, there was a lack of consistency in information received by the Commission (e.g. network capacity, third party access) and this limited the extent to which the Commission could use the information.

It is hoped that the Commission can work with carriers to overcome any concerns and difficulties in this regard in time for the next report.

# Appendix 1. List of participants

| Participant | Response provided (Y/N) |
| --- | :---: |
| AAPT Limited | Y |
| AARNet | N |
| Access Providers Limited | Y |
| ACN 008 889 230 Limited (Neighborhood Cable) | Y |
| Agile | N |
| AirNet Commercial Australia | N |
| Alphalink (Australia) Pty Ltd | Y |
| Amcom Telecommunications Limited | Y |
| A.P.J.Net Pty Ltd | N |
| Arafura Connect Pty Ltd | N |
| ARBT Pty Ltd | N |
| Australasia IT Pty Ltd | N |
| Australia-Japan Cable (Australia) Limited | Y |
| Bareena Holdings (Quadrant Iridium) | Y |
| Big Air Australia Pty Ltd | Y |
| Boeing Australia Limited | N |
| Bright Telecommunications Pty Ltd | N |
| Broadcast Engineering Services | Y |
| Central Coast Internet | Y |
| Chariot Internet Limited | Y |
| Chime Communications | N |
| COMindico Australia | N |
| Coretel Communications | N |
| Country Energy | Y |
| Datafast Carrier Services | N |
| Digital River Pty Ltd | N |
| Digital Distribution Australia Pty Ltd (formerly ntl Telecommunications Pty Ltd) | N |
| Eastern Wireless Pty Ltd | Y |
| Eftel Radio | N |
| Ergon Energy Telecommunications Pty Ltd | Y |

| Participant | Response provided (Y/N) |
| --- | --- |
| eSat Communications Pty Ltd | N |
| Etherware Networks Pty Ltd | Y |
| ETSA Utilities | N |
| Fox Consulting Group Pty Ltd | Y |
| Global Dial Pty Ltd | N |
| Great Southern Energy | N |
| Highlands Internet | N |
| Horizon Telecommunications Pty Ltd | N |
| Hutchison Telecommunications | Y |
| I.Q.Networks Pty Ltd | N |
| Integrated Community Networks Pty Ltd | Y |
| Integrated Data Labs | N |
| Ipera Communications | Y |
| iPSTAR (Australia) Pty Ltd | Y |
| iWireless Pty Ltd | Y |
| Light Technologies Pty Ltd | N |
| Link Innovations Pty Ltd | Y |
| Linknet Communications NSW Pty Ltd | Y |
| Macquarie Corporate Telecommunications Network | Y |
| MCI WorldCom Australia | Y |
| Mibroadband Pty Ltd | Y |
| National Power Services Pty Ltd | Y |
| New Skies Networks Pty Ltd | Y |
| Nextgen Networks Pty Ltd | Y |
| Norlink Communications Ltd | Y |
| Northern Technology Solutions Pty Ltd | Y |
| Nowires Pty Ltd | Y |
| OMNIconnect Pty Ltd | Y |
| Omninet Wireless Pty Ltd | N |
| Optentec Pty Ltd | Y |
| Oz Telecom Pty Ltd | N |
| Oziplex Pty Ltd | N |

| Participant | Response provided (Y/N) |
|---|---|
| Pacific Wireless Australia Pty Ltd | N |
| PanAmSat Asia | Y |
| Personal Broadband Australia Pty Ltd | Y |
| PIPE Networks (formerly IX Services Australia) | Y |
| Pivotel Group Pty Ltd | Y |
| Planet Netcom Radioworx Pty Ltd | N |
| Polyfone Pty Ltd | N |
| Port of Brisbane Corporation | Y |
| Powercor Australia Telecommunications | Y |
| PowerTel Limited | Y |
| Primus Telecommunications | Y |
| Quantum Multimedia Communications | N |
| Quint-Essential IT Solutions Pty Ltd | N |
| Reach Networks Australia Pty Ltd | N |
| Regional Wireless Pty Ltd | N |
| satellite-wireless.com | Y |
| SCCL Australia Ltd | N |
| Skyways Internet Pty Ltd | N |
| SingTel Optus | Y |
| Soul Pattinson Telecommunications | N |
| Southern Phone Company Limited | Y |
| Spencer Gulf Telecasters | N |
| Swiftel Communications | Y |
| Telecasters Communications Pty Ltd | N |
| Telstra Corporation Limited | Y |
| TransACT Capital Communications Pty Ltd | Y |
| Uecomm Limited | N |
| Unwired Australia | Y |
| Veridas Communications Pty Ltd | N |
| Vertical Telecommunications Pty Ltd | N |
| Victorian Rail Track Corporation | Y |
| Vodafone Pacific Limited | Y |
| Westnet Pty Ltd | Y |

| Participant | Response provided (Y/N) |
|---|---|
| WIA Networks Pty Ltd | N |
| Windytide (AUSTAR) | Y |
| Wobygong Pty Ltd | N |