

AUSTRALIAN *FLEXIBLE LEARNING* FRAMEWORK

Managed by the Flexible Learning Advisory Group on behalf of all States and Territories in conjunction with ANTA

Telecommunications Pricing Structures in Education and Training

**RESEARCH REPORT
June 2001**

AUSTRALIAN *FLEXIBLE LEARNING* FRAMEWORK

Managed by the Flexible Learning Advisory Group on behalf of all States and Territories in conjunction with ANTA

Telecommunications Pricing Structures in Education and Training

Franco Papandrea
John Asman

Communication and Media Policy Institute
University of Canberra

and

Peter Farr

Peter Farr Consultants Australasia Pty Ltd

**RESEARCH REPORT
June 2001**

An initiative within the *Australian Flexible Learning Framework for the National Vocational Education and Training System 2000 – 2004*.

ISBN 0-642-48740-5

Copyright:
© 2001 Australian National Training Authority

This work has been produced with the assistance of funding provided by the Commonwealth Government through the Australian National Training Authority. Copyright for this document vests in ANTA. ANTA will allow free use of the material so long as ANTA's interest is acknowledged and the use is not for profit.

Foreword

Background

In August 1999, the Australian National Training Authority Chief Executive Officers (ANTA CEOs) endorsed the Australian Flexible Learning Framework for the National Vocation Education and Training System 2000 – 2004 (AFL Framework). The Framework has been developed by the Flexible Learning Group (FLAG) and represents a strategic plan for the five-year National Project allocation for Flexible Learning. It is designed to support both accelerated take-up of flexible learning modes and to position Australian Vocational Education and Training (VET) as a world leader in applying new technologies to vocational education products and services.

The AFL Framework is supported by an annual implementation plan, and the plan for 2000, Strategy 2000, was endorsed by ANTA CEOs in September 1999. It identifies specific initiatives and an allocation of resources within each of the five Goal areas identified in the Framework.

Role of the *Flexible Learning* Advisory Group

In broad terms, FLAG is a strategically-focused group of senior VET personnel advising ANTA CEOs, the ANTA Board, Department of Education Training and Youth Affairs (DETYA) and the EdNA Reference Committee on national issues related to the directions and priorities for flexible learning in VET, with particular reference to online technologies.

FLAG has been the lead national body to facilitate national collaboration for flexible learning in VET for more than three years and has been responsible for facilitating national collaboration in a range of significant areas.

It is therefore with great pleasure that we present the “Australian Flexible Learning Framework for the National Vocational Education and Training System 2000 – 2004”, as an invaluable tool to guide us into this new age.¹

Acknowledgments

The authors are grateful to Professor Warwick Blood for his assistance in the analysis of the survey results and to Linda Zakman and Dimi Faloutsos for their assistance in the administration of the survey.

¹ The New Economy Index, Progressive Policy Institute, URL: www.dicppi.org

Executive Summary

This study was commissioned by the Department of Employment Education and Training on behalf of the Education Network Australia Vocational Education and Training Advisory Group (EVAG) within the context of Strategy 2000 for the implementation of EVAG's 'Flexible Learning for the Information Economy' initiative.

The study is an element of a broader project to identify options for access to technological infrastructure to enhance the availability of Vocational Education and Training (VET) services through flexible learning methodologies. Its objectives are to:

- identify current service providers of telecommunications services to the education sector;
- identify other potential service providers of telecommunications services to the education sector;
- obtain details of the current pricing structures for the delivery of telecommunication services to the education sector; and
- identify the current costs of Voice-over IP delivery and the likely future trends, including costs of transferring from voice circuits to VoIP.

A national survey of the use of telecommunications services by education and training providers, conducted by the consultants in early 2001, was a primary source of information for the study. Discussions with experts in State and Territory agencies were another important source of information, particularly in identifying differences between the States and Territories.

The education and training sector is a major user of, and has an increasing demand for, telecommunications services. Its demand is driven primarily by the integration of telecommunications and multimedia services in teaching and in the delivery of education services. Applications with increasing bandwidth requirements are rapidly being introduced as part of delivering a modern-day education or training curriculum.

Competition has been the key to improved telecommunications services and reduced prices. While strong competition has developed in metropolitan areas since the introduction of deregulation in 1997, it has had a much smaller impact in other areas, particularly rural and remote areas.

Current and potential service providers

Education and training providers located in major metropolitan areas have benefited from the presence of several competing carriers vying to secure customers for their services. Some of the larger metropolitan institutions responding to the survey indicated that they used several different carriers to supply their needs. For instance, a university in a large capital city used Telstra for its standard telephony services, Optus for its incoming local rate ('1300') services, and a third carrier for its wide area data communications services.

The survey found that Telstra was the primary carrier used by the vast majority (80 per cent) of education and training providers in all areas and in all States and Territories. The proportion of respondents using Telstra as a primary carrier was lowest in metropolitan areas (77 per cent). For Internet services, however, although Telstra was the largest

provider of services, only 20 per cent of education and training providers use it as their ISP.

While alternative carriers are available in most areas, most of the alternative service providers outside metropolitan areas and some larger regional centres rely on access to Telstra's infrastructure or on arrangements to resell Telstra's services to supply customers. This is likely to constrain downward movement of prices in those areas, at least in the short term and probably until competitive infrastructure is established.

For a significant proportion of public sector education and training institutions, the choice of carrier is mandated by central office policy usually related to sector-wide or government-wide purchasing contracts or arrangements.

Data and internet services

As services most likely to be used to deliver flexible learning, data and Internet services were of particular interest in the study. The type of Internet connection used by an education and training provider determines the range of services it can adequately access and deliver. Over half of all respondents had Internet connections via a dial-up or permanent modem. Such connections, which would not be adequate for the delivery of flexible learning services, however, were concentrated among private VET and ACE providers (70 per cent and 74 per cent respectively), suggesting that most of the small providers make little use of the Internet. Schools were much more likely to have an ISDN connection (59 per cent) or a broadband connection (an additional 21 per cent). Internet connection for TAFEs were mainly either ISDN (35 per cent) or broadband (40 per cent). For universities, a broadband connection was almost universal (85 per cent). In all cases, the larger the institution in terms of enrolment size, the larger its Internet connection.

Telecommunications expenditure

Most education and training providers incur considerable (relative to their size) expenditure on telecommunications services. In calendar year 2000, expenditure on telecommunications services among education and training providers ranged from less than \$1,000 for a small community education organisation, to over \$1.5 million for some larger universities. Typical expenditures for the various types of education and training providers were:

Category	Telecommunications Expenditure (\$ pa)	Telephone Access + Local Call Charges	Data & ISP Charges
ACE Provider	11,000	55%	9%
Private VET Provider	19,000	34%	16%
Secondary School	38,000	63%	13%
TAFE	260,000	44%	19%
University	420,000	45%	18%

For a typical ACE provider, 55 per cent of its telecommunications expenditure was for access (telephone and fax lines and equipment) and local calls. Data/ISP services were relatively unimportant representing about 9 per cent of total expenditure.

For a typical private VET provider, access and local calls accounted for 34 per cent of total expenditure. Long distance and mobile calls were a relatively substantial proportion of total expenditure (47 per cent) and Internet costs were also a significant proportion (16 per cent).

A typical school used 63 per cent of its total telecommunications expenditure on access and local calls. Data and ISP services were 13 per cent of total expenditure.

Access and local calls contributed 44 per cent to the total telecommunications expenditure of a typical TAFE. Long distance and mobile calls contributed 25 per cent and data/ISP costs 19 per cent. Maintenance and other costs were also significant accounting for 12 per cent of the total. The typical distribution of the telecommunications expenditure of a university was found to be similar to that of a typical TAFE: 45 per cent for access and local calls; 25 per cent for long distance and mobile calls; 18 per cent for data/ISP services and 12 per cent for maintenance and other costs.

Average prices

Prices paid for telecommunications services by education and training providers tend to be consistently lower in metropolitan areas than in other areas. However, prices for basic telephony services (access lines and local calls) varied little between sectors and between metropolitan and other areas, largely reflecting the influence of price control regulations that apply to them. Greater variability was evident in the prices of other services.

Enrolment size was significantly correlated with prices for services. Typically, the larger the enrolment size the lower the price paid. This was particularly the case for mobile services. The price of data and private lines was found to increase with enrolment size. However, the increases in these cases were primarily due to the larger capacity connections typically required to cater for the needs of larger institutions.

State variations

Arrangements for the provision of telecommunications services in the States and Territories tend to reflect differences in Agency structures and responsibilities and complexities of delivering services to differently distributed populations. Historical, political and other legacy factors also contribute to the differences.

Most States and Territories have or are developing centralised purchasing arrangements for the supply of telecommunications services, particularly data services, to government-owned education institutions. These vary from the establishment of dedicated networks, such as VicOne in Victoria, to the purchase of services from designated carriers at centrally negotiated prices. In some States, centralised arrangements are in place only for schools.

Access to centrally provided or negotiated arrangements in some States is extended to non-government education and training providers. Non-government schools, for example, have access to government arrangements for the education sector in Victoria, Western Australia, Tasmania and the Northern Territory. Similar access is planned for the future in South Australia and the ACT. Private VET and ACE providers do not typically have access to centrally negotiated arrangements. Some initiatives in this regard, however, are emerging in some States (for example, Victoria).

Voice over IP

Technological advances are increasingly improving the feasibility of VoIP services — the carriage of voice communications over the Internet or corporate data networks (discussed in detail in Chapter 8). The main driver for the introduction of VoIP in the education and training sector is the possibility of integrating such services with existing data networks and facilities thus offering the potential for reduced voice telephony costs.

However, while VoIP has the potential to lower call costs (but only long distance calls), its introduction involves additional establishment and operating costs that may outweigh the savings in call costs. Continuing reductions in long distance call rates, flowing from increased competition, and technological advances likely to reduce the cost of establishing VoIP facilities have opposing effects on the related cost-benefit trade-offs and will need to be taken into account in development strategies. Quality of service of VoIP is another important consideration.

The conclusion of the analysis in this study is that while the attractiveness of VoIP is increasing, it does not seem to have reached the point where its introduction in situations such as those found in the education and training sector is likely to lead to the realisation of substantial benefits just yet.

Action plan

The report concludes with several recommendations and suggested actions for consideration by EVAG as follows:

1. Commission a study to extend the findings of this research and quantify current and foreseeable levels of demand for telecommunications services (including Internet) for the entire education and training sector. (Such information would enhance the capacity of education and training authorities to influence the development of procurement policies and secure more favourable arrangements for the supply of services).
2. Evaluate the different practices for the provision of telecommunications services currently in use in the States and Territories with a view to developing best practice approaches most suited to the prevailing circumstances in each jurisdiction.
3. Examine successful arrangements involving the coordination and aggregation of telecommunications demand from both government and non-government education providers for possible implementation in other jurisdictions.
4. Explore the potential for extending or emulating successful arrangements implemented in the secondary schools sector to the VET sector.
5. Evaluate the potential of demand aggregation initiatives to achieve cost savings and better quality telecommunications services for ACE and private VET providers.

Contents

Foreword	v
Acknowledgments	v
Executive Summary	vi
Contents	xi
Abbreviations	xiv
1. Introduction	1
2. Telecommunications Services: Structure and Competition	3
Overview	3
Carriers	4
Customer access	6
Data services	9
Voice over Internet protocol	11
3. Communications and the Education Sector	12
Introduction	12
Overview of States and Territories telecommunications arrangements	12
New South Wales	13
Victoria	14
Queensland	15
Western Australia	16
South Australia	17
Tasmania	18
Australian Capital Territory	18
Northern Territory	19
Some general observations	20
4. The Survey	22
Objectives	22

Survey sample size and responses	22
Sources of information	23
The survey questionnaire	24
Survey administration	24
Analysis of survey data	25
5. Supply of Telecommunications Services to Education and Training Providers	26
Current service providers	26
Mandated choice of carrier	28
Availability of other carriers	28
Internet services	29
6. Telecommunications Expenditure	33
Aggregate expenditure	33
Expenditure on access lines	33
Expenditure on access lines	34
Expenditure on local calls	35
Expenditure on local calls	36
Expenditure on long distance calls	36
Expenditure on long distance calls	37
Expenditure on mobile telephony	37
Expenditure on mobile telephony	38
Expenditure on data communications	38
Expenditure on data communications	39
Telecommunications expenditure profiles	40
7. Prices of Telecommunications Services	44
Average prices per unit of service	44
Prices and enrolment size	45
Regional price variations	45
8. Prospects for Voice over IP in the Education and Training Sectors	47
Introduction	47
Current use	47
Public carriers and carriage service providers	48

Current use on corporate wide area networks	49
Prices of public VoIP services	50
Comment	51
Prospective developments and trends for VoIP	51
Benefits of IP VPN to the education and training sector	52
Feasibility of VoIP	52
Conclusions on VoIP	53
9. Conclusions and Recommendations	55
Conclusions	55
Recommendations	57
Action items	58
10. References	59
Appendices	60
Appendix 1: Current and Proposed Major Networks	61
Appendix 2: Survey Methodology and Documents	65
Identification and selection of survey sample	65
The survey instrument	67
Australian Flexible Learning Framework	67
Telecommunications and Internet Pricing Structures Survey	67
Director	73
Appendix 3: Voice over IP (Technical Aspects)	74
Quality of service considerations	74
Setting up VoIP	75
Trends and developments	76
Future costs and feasibility	76

Abbreviations

AARNet	Australian Academic and Research Network
ACE	Adult and Community Education
ADSL	Asynchronous Digital Subscriber Line (or Loop) – a technology that enables transmission of high bandwidth data on ordinary copper cable pairs in the customer access network
ASP	Application Service Provider
ATM	Asynchronous Transfer Mode – high bandwidth, low delay technology for transmitting voice, data and video signals
Broadband	Transmission capacity with sufficient bandwidth to permit the combined delivery of voice, data and video services (usually thought of as at least 500 kbps)
bps	Bits per second
BTS	Basic Telecommunications Service panel contract (government agencies in WA)
Byte	8 data bits
CEO	Catholic Education Office
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DDS	Digital Data Service (permanent, highly reliable data line)
DSL (xDSL)	Digital subscriber line system ('x' used to represent generic applications)
EVAG	Education Network Australia Vocational Education and Training Advisory Group
FR	Frame Relay – data communications protocol
Gbps	Gigabits per second
GB	Gigabyte
HFC	Hybrid optical fibre and coaxial cable
Intranet	An Internet-based communications system for information sharing within an organisation or a closed user group
IP	Internet Protocol – data communications protocol that defines rules for transforming data into packets for transmission over a network
ISDN	Integrated Services Digital Network – a technical standard for a network capable of transporting many services (voice, data, video) over the same network infrastructure

ISP	Internet Service Provider
ITSP	IP Telephone Service Provider
kbps	Kilobits per second
LAN	Local Area Network
LATIS	Learning and Technology in Schools – telecommunications provisions arrangements for secondary schools in the Northern Territory
LMDS	Local Multipoint Distribution System
Mbps	Megabits per second
MMDS	Multichannel Multipoint Distribution System
NTIS	National Training Information Service
NTN	Networking the Nation (Federal Government program for rural and remote areas, and Island territories)
PABX	Private Automated Branch Exchange
POP	Point of Presence
PSTN	Public Switched Telephone Network – the combined networks of all operators over which telephone services are provided to the public
QoS	Quality of Service
RTO	Registered Training Organisation
RFP	Request for Proposals
Scalable	the ability to increase capacity while maintaining functionality and/or quality
STA	State Training Authority
STEP	Statewide Telecommunications Enhancement Program (WA)
STD	Subscriber Trunk Dialing
TCP/IP	Transmission Control Protocol/Internet Protocol
ULL	Unconditioned Local Loop – copper pair connecting a service to the telephone network
USO	Universal Service Obligation – regulatory requirement to ensure that standard telephone services, payphones, digital data services, and prescribed carriage services are available to all people in Australia on an equitable basis wherever they reside or carry on business
VAS	Value Added Services
VSAT	Very Small Aperture Terminal (satellite technology)

VET	Vocational Education and Training
VISP	Virtual Internet Service Provider
VicOne	Victorian Government Data Network
VoIP	Voice over Internet Protocol
VPN	Virtual Private Network
WAN	Wide Area Network
WAP	Wireless Application Protocol
Wideband	Usually thought of as at least 10 Mbps
WLL	Wireless Local Loop

1. Introduction

This study was commissioned by the Department of Employment Education and Training on behalf of the Education Network Australia Vocational Education and Training Advisory Group (EVAG) within the context of *Strategy 2000* for the implementation of EVAG's 'Flexible Learning for the Information Economy' initiative to achieve more flexible learning in Vocational Education and Training (VET). Goal 2 'Supportive Technological Infrastructure' of *Strategy 2000* aims to achieve a national VET system that:

- facilitates affordable access by all communities, learners and employers to online services;
- is underpinned by advanced information and communications technologies;
- achieves connectivity and associated interoperability in the application of technology to delivering training services and, where required, to its business processes.

The study is part of a broader project that seeks to identify options to facilitate VET staff and student access to the technological infrastructure necessary to increase the quality and quantity of VET services available through flexible learning methodologies. The study is intended to inform EVAG about the current pricing structures for the delivery of telecommunications services and how they affect the education system and to facilitate the development of future policy and strategic directions.

In particular, in commissioning the study, EVAG was seeking to:

- identify current service providers of telecommunications services to the education sector (Schools, TAFEs, Higher Education, and Private VET and ACE providers) in each State and Territory, including comparison between metropolitan, regional and remote delivery.
- identify other potential service providers of telecommunications services to the education sector in each State and Territory, including comparison between metropolitan, regional and remote delivery.
- obtain details of the current pricing structures for the delivery of telecommunication services to the education sector in each State and Territory, including comparison between metropolitan, regional and remote delivery.
- identify the current costs of Voice-over IP delivery across all States and Territories and the likely future trends, including costs of transferring from voice circuits to VoIP.

The following key parameters were to be taken into account in the conduct of the study and the preparation of this report:

- different infrastructure existing in different states and territories. In some States, some institutions such as TAFEs and Universities have their own inter-campus infrastructure for telecommunications services;
- the telecommunications strategies adopted by the various states and territories that impinge or determine the services and prices faced by educational institutions; and
- technological developments that are likely to influence both demand and supply of telecommunications services.

The primary source of information on the use of telecommunications services by the education sector was a national survey of public and private sector educational and training institutions undertaken as part of the study. The survey collected information on the nature, range and pricing structure of telecommunications services.

In addition to the information collected in the survey, the consultants procured relevant information from a variety of public and private sources, and from discussions with experts in Central Offices of State and Territory agencies dealing with telecommunications issues in VET organisations.

The report is structured as follows:

- Chapter 2 provides a discussion of the Telecommunications Services Sector in terms of structure and competition in the delivery of services focusing on those that are particularly relevant to the Education and Training Sector.
- Chapter 3 is devoted to discussion of broad telecommunications policies and arrangements for the Education and Training Sector currently in place in each of the States and Territories.
- Chapter 4 provides details of the survey of education and training institutions to collect information on the structure and pricing of telecommunications services.
- Chapters 5, 6 and 7 discuss the main survey findings in relation to; competitive provision of services (Chapter 5), telecommunications expenditure (Chapter 6), and prices paid for services (Chapter 7).
- Chapter 8 provides a discussion of Voice over IP issues.
- Chapter 9 details some broad conclusions arising from the study and provides recommendations for future action.

2. Telecommunications Services: Structure and Competition

Overview

The information revolution is rapidly changing the nature and range of services supplied by the Australian telecommunications services industry. In addition, the progressive liberalisation of the industry, culminating with the introduction of open competition in 1997, has led many new service providers to enter the industry. While Telstra was once the only carrier and service provider in the domestic market, there are now over 60 carriers and some 100 telephone service providers operating in the market. There are also over 800 Internet service providers.

Although Telstra continues to be the dominant supplier in most sectors of the market, the entry of new carriers and service providers has reduced its market share (considerably in some sectors) and has benefited consumers by providing competitive sources of supply. Competition, however, is not spread uniformly across the country and across services. Service provision in all major metropolitan areas has become highly competitive. Competition has also spread to some major regional centres, but has made little inroads elsewhere. In terms of services, long distance, international and mobile telephony services are highly competitive, but little competition has emerged for local call services. Internet and data services in most major geographical markets are highly competitive.

Developments in competitive infrastructure investment provide one measure of competition in the supply of services. Large metropolitan markets have attracted considerable investment in competitive infrastructure and so have trunk routes between major metropolitan centres. Some competitive infrastructure has also been installed in large regional centres, mainly in those passed by major trunk routes. Elsewhere, competitive infrastructure has been slow to emerge or is nonexistent. Primarily this appears to be due to low population densities and consequential relatively low aggregate demand for telecommunications services making investment in additional infrastructure commercially unattractive. Low population densities also increase the costs of establishing infrastructure. The Productivity Commission (2000) estimates that the average line costs in low line density areas of Australia are between six and 10 times the average cost per line in the rest of Australia.

Competition is a key factor in the pricing of telecommunications services. Firms typically use multiple strategies to compete in product markets. In telecommunications markets, however, services are difficult to differentiate and price tends to be the primary form of competition between suppliers. Increased competition since deregulation has produced considerable reductions in the prices of services where carriers and service providers have been competing aggressively for customers (Jennings, 2000). These include lower prices for long distance and international calls, mobile services and Internet and data services. Prices of local telephony services, where competition is weakest, have not declined significantly (the recent announcement to introduce extended local call zones will reduce costs for consumers in affected rural areas).

Carriers

Although there are more than 60 licensed carriers, several of them are related entities; Telstra, for example, has two licences and Cable and Wireless Optus (Optus) has four. Some do not offer services to the general public but have that status because they carry limited third party services on what are otherwise private networks. Others, although licensed, are not yet established in the market, but have announced plans or intentions to establish new networks. In addition, there are some 100 Carriage Service Providers, including licensed carriers and resellers of services. Much of the carrier/service provider activity is concentrated in major metropolitan centres and in networks connecting those centres.

Existing and proposed backbone infrastructure is largely concentrated in the Brisbane-Sydney-Melbourne corridor. Three carriers, Telstra, Optus and PowerTel, account for virtually all of the established optic fibre networks linking those three cities. The Optus network extends to Adelaide and Perth, while Telstra's network has a nationwide presence linking the capital cities of all States and Territories and major centres in between. Another carrier, AAPT leases optic fibres from Optus linking Melbourne with Geelong and Brisbane with the Gold Coast. Optus is proposing to extend its optic fibre network from Brisbane to Cairns and PowerTel is proposing to add a separate route to its Brisbane-Sydney-Melbourne links (Telstra and Optus already have two separate routes). Proposals for additional major optic fibre backbone networks include Amcom (Melbourne-Adelaide-Perth), Nextgen (Brisbane-Sydney-Melbourne-Adelaide-Perth), AFN (Brisbane-Sydney-Canberra-Melbourne) and SouthTel (a loop joining Sydney to major centres along the NSW coast south to Eden continuing through inland locations including Cooma, Canberra, Goulburn and other centres. Typically, these carriers also establish optic fibre rings connecting large users in capital cities and larger regional centres to supplement their backbone networks.

Microwave transmission technology provides a terrestrial alternative to optic fibre backbone networks. Several carriers have adopted this technology. Telstra use microwave transmission to provide alternative routes to some of its optic fibre links and to provide regional links to its backbone network. Major operators of existing and proposed microwave backbone networks include Soul Pattinson Telecommunications (Sydney-Brisbane with planned extension to Melbourne), Macrocom (Brisbane-Sydney-Canberra-Melbourne with current or planned construction of extensions to Adelaide, Hobart and Rockhampton), Datafast (planned network linking Melbourne to major regional centres in Victoria), Telecasters Communications (proposed links between Brisbane and Cairns), NTL Telecommunications (proposed Cairns to Hobart network linking major regional centres on route), and Agile Communications (proposed link between Adelaide and centres in the Coorong and Murray Bridge districts of South Australia). Major infrastructure developments are summarised in Table 1. Maps showing the location of current infrastructure and proposed major infrastructure developments are provided in Appendix 1.

Table 1: Examples of New Infrastructure Providers in Regional Australia^a

Area	Operator	Network details (including planned deployments)
Regional city local access networks	Neighborhood Cable	HFC networks in Mildura, Ballarat and plans for Bendigo and Albury-Wodonga.
	Smart Radio Systems	'Fibre to the home' network planned for Cooma.
	TransACT	Rolling out a fibre optic network in Canberra and Queanbeyan.
Australia-wide	AAPT	Deploying a national LMDS network.
	Agility Networks	Deploying national LMDS network focused on regional Australia.
	Pulsat	Building a wireless network targeting regional areas.
	AMX Communications	Deploying a national microwave network with wireless local loop.
	Austar	Services to regional/rural Australia via satellite/wireless networks.
	Airnet	Services to rural Australia via satellite/wireless network.
	COMindico	Plans to deploy Australia's first pure IP network by installing nodes in all 66 Telstra call charging areas.
	ARBT (Heartland Communications)	Provision of telephony and broadband services to rural and regional Australia using satellite technologies.
	BinCom Satellite Systems	Services to regional/remote areas of Australia using a satellite-based network and VSAT (Very Small Aperture Terminal) technology.
Pacific Telco	Planning services to rural/remote areas using VIP SatNet (Voice Over Internet Protocol Satellite Network) technology.	
Victoria	OMNICConnect	Wireless network to service Melbourne and Mornington Peninsula.
	Advanced Cellular Technologies	Wireless network to service Melbourne and south-eastern Victoria.
	ntl Telecommunications	Plans as part of a backbone network points of presence in Albury-Wodonga and Mildura.
NSW	Soul Pattinson	Interconnection to Brisbane-Sydney backbone from northern NSW centres such as Newcastle, Taree, Port Macquarie, Coffs Harbour, Lismore and Tamworth.
	SouthTel	Plans to deploy a fibre optic backbone from Sydney to South Coast, with services to Bega, Eden and other centres.
	ntl Telecommunications	Plans points of presence in towns such as Tamworth, Dubbo and Griffith as part of backbone network.
Queensland	Soul Pattinson	Interconnection to Brisbane-Sydney backbone from SE Queensland centres such as Tweed Heads and Gold Coast.
	ntl Telecommunications	Plans backbone network with regional points of presence in towns such as Toowoomba.
South Australia	Agile	Wireless-based network to service rural areas
Western Australia	iiTel	Wireless network to service regional and remote centres.
	Swiftel	Plans wireless network to service rural areas such as Kalgoorlie, Geraldton, Albany, Karratha and Port Headland.
	Netcare	Microwave rollout in rural and regional areas.
	Bush Telegraph	Plans services to regional areas in WA and the NT, including Broome, Alice Springs, Derby, Darwin, Geraldton, Port Headland, Karratha and Katherine
Tasmania	ntl Telecommunications	Plans Cairns-Hobart backbone network with points of presence in Tasmania.

Note: a: Includes announced network deployment by organisations not yet been granted a carrier licence.

Source: Productivity Commission (2001)

Customer access

The relatively high level of facilities based competition evident in backbone network services stops short of the customer access network. To date, the fixed 'local loop' network has attracted little infrastructure investment by new carriers. The little that has been undertaken or is planned is concentrated in capital cities and large regional centres. The most important technologies deployed in customer access networks are optic fibre, hybrid fibre and coaxial cable (HFC) and wireless local loop. Optic fibre rings are concentrated in inner metropolitan areas of large cities.

In addition to Telstra's traditional and optic fibre networks and Optus optic fibre rings and HFC systems in large state capital cities, companies investing in optical fibre rings include PowerTel, UeComm, AAPT, MCI Worldcom and Amcom. Other large centres attracting investment in optic fibre or HFC customer access networks include Newcastle (Ipera), Canberra (TransACT), Cooma (Smart Radio Systems), and Mildura, Ballarat and possibly Bendigo and Albury-Wodonga (Neighbourhood Cable).

Broadband wireless local loop systems are being developed or are planned by several carriers primarily in larger regional centres. AAPT is developing a LMDS (local multipoint distribution system) network with a planned coverage of more than 20 of the largest regional centres such as Geelong, Ballarat, Wollongong, Newcastle, Gold Coast, Cairns, Mount Gambier, Kalgoorlie, Launceston and Alice Springs. Austar United Communications is developing a MMDS (multichannel multipoint distribution system) network with a planned coverage of more than 60 towns and cities targeting business and government users. Hutchison telecommunications is planning to a national high speed wireless network in mainland state capital cities. Other carriers, including Optus, have indicated they will be seeking to acquire spectrum to develop similar systems. Optus is also planning to launch a new satellite in early 2002 to augment its existing satellite services as well as provide new services such as direct-to-home television, telephony, Internet and broadband data.

Other developments in regional areas should also assist the development of improved customer access services. With financial assistance from the Commonwealth Government's Networking the Nation (NTN) program, some local initiatives are being developed to establish regional carriers to improve telecommunications services. Broadly these initiatives are based on aggregating demand for telecommunications services within a region and to supply that demand through investment in local infrastructure in partnership with established carriers. Examples include initiatives in the Riverina and Northern Rivers districts of New South Wales, and the Greater Green Triangle, Gippsland and Shepparton Districts of Victoria. These have tended to be broadly based community initiatives rather than for particular sectors such as improvement of services for education and training providers. Nonetheless, the emergence of regional carriers in some states will inject desirable improvements in the delivery of regional telecommunications services of potential benefit to local education and training providers. In rural and remote areas, where local demand is unlikely to be sufficient to justify competitive infrastructure investment some benefits will arise from Government funded initiatives such as the introduction of untimed local-rate calls in 'extended local call zones'.

Table 2: High Bandwidth Infrastructure (in place or planned)

Carrier	Location	Delivery by	Status	Technology
AAPT	CBDs in Melbourne, Sydney, Canberra, Brisbane, Adelaide, links to regional centres such as Geelong and Gold Coast.	Fibre optic	In operation	ATM, FR, VPN, IPLC, Internet (broadband, e-commerce)
	Mainland capital cities	LMDS	In operation (20 nodes by May 2000)	146 nodes to be in operation by Dec. 2001 of which 46 will be in regional areas
Agile	Adelaide	Broadband wireless data	In operation	Will offer voice services in future
AirNet	Adelaide	Microwave broadband	In operation	Planning national broadband microwave rollout. High speed data
Amcom/ Fibertel	Perth and Adelaide Darwin	Fibre optic	In operation	
		Fibre optic	Planned	
C W Optus	National	HFC ATM, fibre optic	In operation	ATM, FR, VPN, VAS, Pay TV
Chello broadband	16 regional towns	Satellite broadband	In operation	Further 26 regional rollouts (2000), metro rollouts with Austar
Davnet	Melbourne and Sydney	Fibre, microwave	In operation	ATM, FR, VPN, Internet
MCI Worldcom/ UUNet (OzEmail)	Melbourne and Sydney CBDs	Fibre optic	In operation	ATM, FR, Internet
OMNI- connect	Metropolitan areas	Wireless networks	In operation	ATM, FR, Internet (broadband), wholesale
PowerTel	Melbourne, Sydney and Brisbane CBDs	Fibre optic		
Primus	Melbourne and Sydney CBDs	Fibre optic	In operation	DDS, FR, Internet
Pulsat	Perth, Melbourne and Sydney	Broadband wireless network	In operation	
RSL COM	CBD	ATM Backbone network	In operation	
Swiftel	Perth and WA	Fibre optic	Construction	Internet, ATM and FR
Telstra	National	Fibre optic, HFC	Completed in August 2000	
TransAct	Canberra	Copper and Fibre local network	In operation	Terrestrial TV, Pay TV, video on demand, Internet
UE Comm (United Energy)	Melbourne, Sydney and Brisbane	Fibre optic	In operation	VISP services
Windytide	Regional Australia, Darwin	Hybrid fibre optic	In operation	Pay TV and Internet access services
Xinhua News	Asia Pacific Region	Satellite in Sydney	In operation	Voice and data services for Chinese speakers in Asia Pacific region

Abbreviations: ATM – asynchronous transfer mode, WAP – wireless application protocol, DDS – digital data services, FR – frame delay, HFC – hybrid fibre coaxial, LMDS – local multipoint distribution service, VAS – value added services, VPN – virtual private network, VISP – virtual Internet service provider

Source: ACCC (2000)

In addition to direct infrastructure investment in local networks, new carriers and service providers can compete with incumbent operators by leasing access to local loops from the incumbent carriers. Access to 'essential facilities' such as the local loop is facilitated by the current telecommunications regulatory framework. By gaining access to an 'unconditioned local loop' (ULL) competing carriers and service providers can connect an existing fixed line to their own equipment and provide services to a customer in competition with the owner of the fixed line. The line may be used to provide voice or data services. The development and current deployment of DSL technologies will enable delivery of higher bandwidth data services directly to customers and should enhance the level of competition in the local loop.

Table 3: Deployment of DSL services

Carrier	Routes	Status
AAPT	Unknown	Planned trialing in Sydney CBD exchanges
One.Tel ^a	Unknown	Planned
Primus	Unknown	Trialing ADSL in Melbourne CBD exchanges
Request	Melbourne and Sydney CBD	Commenced operation; Expecting to reach approximately 50 exchanges by end of 2001
Telstra	All capital cities and Launceston, Toowoomba, Bunbury	Commenced operation; planned gradual extension of reach to 7 million homes and 90% of population within 3.5km of ADSL exchanges
XYZed (Optus subsidiary)	Initially SA, Vic, NSW & QLD metro and CBD areas	Commenced operation; Expecting to reach approximately 100 exchanges by end of 2001

A number of carriers (and larger ISPs) are offering or expecting to resell ADSL retail products of other carriers. For instance, Pacific Internet is currently providing ADSL for high speed Internet access via both Telstra and XYZed wholesale products and Primus is offering a residential ADSL Internet access product via Telstra.

Note: a: Administrator appointed May 2001

Source: ACCC (2000)

The supply of fixed local telephony services is dominated by Telstra. Optus provides services to a very small number of subscribers via its Hybrid Fibre-Coaxial Cable consumer networks (primarily developed for Pay TV) in Sydney, Melbourne and Brisbane. Several carriers, including Optus, however resell local access services to customers that preselect them as the preferred carrier for long distance and international services. Local access and local calls are subject to price control regulation and vary little between carriers, particularly in the retail market. Large private and public sector organisations, however, have been able to use their purchasing power to secure competitive deals from carriers. Some of these involve the pricing of local calls on a low per minute time charge (3-5 cents per minute) and discounts on overall expenditure.

The supply of long distance and international calls is very competitive and is facilitated by regulations requiring Telstra to supply originating and terminating services to competitors at prices reflecting the cost of provision. Prices for long distance and international calls have declined considerably since open competition started in 1997.

Mobile services are also very competitive, particularly in metropolitan areas and other major population centres. Pricing packages are typically very complex and often involve subsidised handsets. Three major carriers, Telstra, Optus and Vodafone operate national networks. Several other carriers including AAPT and Hutchison have started or plan to deploy their own networks in major cities and are already active in the market as resellers of the services of the major carriers.

Data services

Demand for data services has been growing rapidly in recent years. Competition on major trunk routes and metropolitan areas has resulted in substantial reductions of bandwidth prices further enhancing demand growth. In other areas, where little effective competition exists prices have not declined to the same degree, cost considerations are undoubtedly constraining demand. The National Bandwidth Inquiry (1999), for example, found that wholesale bandwidth prices have been declining by 30 to 50 per cent per annum in capital cities and trunk routes, but significantly less so in regional and rural areas where competition is weaker. Currently, data telecommunications services, including the Internet represent more than half of total telecommunications services demand (in terms of bandwidth usage) and are continuing to grow much more rapidly than voice services. Corporate demand growth exceeds residential growth by a substantial margin.

Generally, high data-volume or data-intensive activities require high data speeds for transmission. Most large private and public sector organisations, including universities and higher education institutions, require access to high speed dedicated lines for their communication activities. Universities, for example, were early adopters of broadband services and remain high volume users of data services and the Internet for education and research related activities. TAFEs are also increasing their use of broadband data services. Currently, most schools have lesser demands and their needs tend to be adequately catered for with lower bandwidth links, such as ISDN. Budgetary constraints and costs may be limiting the demand of individual institutions. The unit cost of bandwidth for data and Internet services declines substantially with increases in the size of the communication link. Indicative prices for commonly available data and Internet links are provided in Table 4.

Table 4: Typical Internet Communications Link Prices

Type	Bandwidth provided	Price
PSTN Dial-up	28 kbps – 56 kbps	\$140 pa plus ~25c/call
ISDN OnRamp (one channel)	64 kbps	\$1,560 pa
ISDN OnRamp (two channels)	128 kbps	\$3,120 pa
Spread spectrum radio	2 Mbps	\$3,600 pa
Satellite	128 kbps out, 512 kbps shared capacity return. Other options available.	Data Reach ~\$8,000 pa (fully managed service)

Demand for data services, such as frame relay, ATM and leased lines is overwhelmingly driven by business and government applications that largely require the establishment of

local area and wide area networks for the transfer of information. Intranet access for geographically dispersed units of a corporation or large institution can be critical for efficient operations and management as well as for training. E-commerce and e-business applications are also growing rapidly. The availability of fixed broadband networks, however, is currently limited to large cities and some regional areas. In other areas, broadband services are provided primarily via satellite delivery platforms. The availability of broadband Internet services is summarised in Table 5.

Table 5: Broadband Internet Service Providers

Provider/service	Delivery platform	Coverage
Telstra (Big Pond Advance)	HFC cable Satellite/PSTN ^{a,b} ADSL	Sydney, Melbourne, Brisbane, the Gold Coast Areas not covered by cable or ADSL Urban and major rural centres
Cable & Wireless Optus (Optus@Home).	HFC cable	Metropolitan areas of Sydney, Melbourne, and Brisbane
Austar (Chello)	MMDS/PSTN ^a	28 regional areas
Neighborhood Cable	HFC cable	Mildura
Access1	Satellite/PSTN ^a	POPs in NSW, ACT, Qld, SA, WA and Vic.
ihug	Satellite/PSTN ^a	Metropolitan areas of Sydney, Melbourne, Brisbane, Wollongong and Adelaide
iinet	HFC cable, ADSL	Residential estate in Perth (Ellenbrook). Selected suburbs of Perth.

Notes: a: Data are downloaded at broadband rates but the return path is via a standard telephone line.

b: Telstra is planning to offer all extended zone customers an 'always on' two-way satellite based Internet service with a choice of access speeds and prices as part of the implementation of its successful tender to provide untimed local calls and untimed local call access to the Internet in 'extended zones' in rural and remote Australia.

Source: Productivity Commission (2001)

As large consumers of data services, large businesses and government agencies wield sufficient power to secure favourable services and prices. This market power extends to the public education sector and to private systemic schools. Most States and Territories have established centralised policies and telecommunications supply contracts for telecommunications services and particularly for data/Internet services.

Small business and consumer access to the Internet is mainly via a dial-up or permanent modem. Independent education and training suppliers have many of the characteristics of small to medium enterprises generally and have similar communication needs. Most access the Internet via a modem although some of the larger or specialised organisations require ISDN or higher bandwidth links for their needs. The supply of Internet services is very competitive. Several hundred ISPs operate in the market and mergers, start-ups and closures are common. In most areas, other than remote areas of Australia, ISP services are supplied competitively by two or more ISPs. Access prices do not vary significantly from area to area. The estimated distribution of ISPs is shown in Table 6.

Table 6: Distribution of Internet Access Providers

State	Metropolitan	Rural	Total
New South Wales	252	208	363
Victoria	267	309	117
Queensland	164	169	251
Western Australia	153	64	184
South Australia	109	44	127
Tasmania	48	28	49
Northern Territory	46	20	48
Australian Capital Territory	84	0	84
Total	610	458	1023

Note: Individual cells in rows and columns do not sum to the totals shown. This is because the same company can offer services in more than one state, or in both rural and metro areas, but is only counted once in the totals.

Source: Australian ISP List (2001)

Voice over Internet protocol

Since the mid 1990s, the world has had a popular universal standard for data communications - the Internet Protocol (IP). A growing proportion of data networks (including the Internet) are based upon this protocol. The large acceptance and connection to the Internet increased the potential for integrating Voice over IP (VoIP) services.

VoIP refers to the carriage of voice communications over the Internet or corporate data networks (intranets). VoIP differs from traditional voice calls over circuit switched telephony networks where all the information is transported together over a fixed link between the calling parties. At the sender's end, the technology compresses voice signals and converts them into discrete IP 'packets' for carriage over a data network. As for is the case for data transmissions, the packets may travel over different paths to the receiver where they are reassembled to regenerate the original information. While delays encountered by the packets along the transmission path do not usually pose a problem for data communication, they can be a problem for voice and would be evident in the form of quality deterioration.

Information from various sources reported in the Telecommunications Services Inquiry (2000) Report indicates that VoIP use is growing rapidly around the world in response to low costs. The report noted estimates indicating that telephony will account for 20 per cent of all Internet traffic by 2005.

A standard telephone can be used to originate and receive VoIP calls. IP-based networks also have video conferencing capabilities and generally support the concept of collaborative working. VoIP is discussed in detail in Chapter 8.

3. Communications and the Education Sector

Introduction

The education sector is a large user of telecommunications services. According to the recently completed Telecommunications Services Inquiry (2000), the sector – including both public and private providers of higher education, TAFE, VET, ACE, schools and distance education – represents 12 per cent of the telecommunications transmission bandwidth market. Its importance is probably appreciably larger when additional bandwidth usage by students and others accessing educational services and research materials on privately funded services is taken into account. White (1999) found that for 94 per cent of school, TAFE and university students the home was the primary point of their Internet access. The same study found that 96 per cent of educational institutions had access to online services. Adoption of online technologies in educational institutions is increasing rapidly. The cost of access was considered to be the main barrier to more extensive and higher bandwidth Internet connectivity for schools particularly those in non-metropolitan areas.

Access to modern telecommunications has become particularly important for information based services, such as education. Access to information repositories and distance learning delivery opportunities are rapidly changing traditional approaches to education and training. Many educational institutions, both in Australia and overseas are already responding to these changes and are offering courses accessible over the Internet. As noted in the *Flexible Learning for the Information Economy: A framework for National Collaboration in Vocational Education and Training 2000-2004*, the VET sector is meeting the challenge head-on and seeks to position itself as a world leader in applying new technologies to vocational education products and services.

Because of their key role in modern education practice, telecommunications services are attracting increasing shares of the budgets of educational authorities. As telecommunications budgets increase, obtaining value for money becomes an ever more important goal for overall operational efficiency of education and training institutions. Similarly, the availability of adequate infrastructure is crucial to the delivery of services.

States and Territories apply a variety of general and specific policies to the supply of telecommunications services to educational institutions. A brief summary of the most notable arrangements in place in each jurisdiction is provided below.

Overview of States and Territories telecommunications arrangements

To supplement and to provide some general background for the information obtained from the survey, the study team contacted a total of more than twenty senior officials in a variety of relevant Departments in each State and Territory. Departments ranged from those having general responsibility for one or more elements of education, training and employment to those having responsibilities for information technology, information services or telecommunications management.

The officials contacted included those expressly suggested by members of EVAG as well as others independently identified by the study team and those recommended during the

course of telephone discussions. In every case, the officials contacted were willing to assist with the provision of information about the procurement of telecommunications services in their jurisdiction. Some officials possessed a highly detailed knowledge at the practical or implementation level while others had a broader or more strongly policy-oriented focus. Inevitably perhaps, there were some seeming differences of opinion encountered within individual jurisdictions, especially in cases where differences in perspective or responsibility existed. However, given the breadth and complexity of the subject under consideration, it would be unreasonable to read much into such differences. Rather the point remains that the issues raised in the efficient and effective delivery of telecommunications services to the education sector are complex and require a variety of competing interests and objectives to be taken into account.

While there was a clear impression of a vast store of experience and knowledge resident in the officials contacted, it should be recognised that their comments summarised here cannot be taken to provide a complete and comprehensive description of the totality of State and Territory arrangements. The study team considers the summaries provided here to be reasonable and representative in all the circumstances, but not necessarily exhaustive or definitive on every issue in every case. It should also be noted that in a number of jurisdictions telecommunications supply arrangements are either actively evolving or currently undergoing examination and review. Substantial changes to existing arrangements were quite frequently foreshadowed.

More generally, the dynamic character of the telecommunications industry and the diverse nature of State and Territory needs, historical factors and political circumstances combine to prevent any simple description of the arrangements applying across the nation. What follows here therefore is a summary of comments and observations made by a number of officials in each jurisdiction. These summaries provide a general overview of the variety of differing State and Territory arrangements made for supply of telecommunications services to both the VET and secondary education sectors.

New South Wales

In both the VET and secondary education sectors, there are a range of central controls and guidelines applying. Some of these are considered to be in need of updating and do not lead to best possible pricing outcomes today.

There are a number of quite complex general State telecommunications services agreements that are complementary to other agreements such as those relating to mobile telephony and related wireless services agreements and government network services agreements. The State Contracts Control Board plays a role in the coordination of all contract requirements.

Telephony services are provided under a State Government Telecommunications Services Agreement. The agreement enables schools, both public and private, to obtain pre-negotiated, up-front discounts or total use rebates from a list of service providers. The agreements provide varying levels of discounts that average about 17% overall and can range up to 50% for some specific services (for example STD calls).

For data services, the Department of Education and Training, as the State's largest user with 2,500 land links, pursues a more independent line. The Department finds that from a field of 6 telecommunications providers it can negotiate very good prices, especially with

new service providers, for parts of its 100 Mbps bandwidth requirement. It is currently pilot testing and proving the use of new technologies in metropolitan and regional areas.

The Department notes that some centrally arranged contracts having 3 to 5 year terms can prevent larger, specialist agencies from taking advantage of newly emerging opportunities and prices. The Department has found that by negotiating with the newer and smaller carriers it can achieve quite large benefits that it would not be able to obtain if it attempted to negotiate solely and directly with the older and larger carriers.

In the hope of winning further business, new suppliers might, for example, offer 20 fold increases in bandwidth for the price sought by older suppliers. Often the older and larger carriers will subsequently offer to match competitive arrangements secured with the smaller carriers.

The typical benefit secured in negotiations is not usually a price reduction but more typically takes the form of the provision of much greater bandwidth for the same price. For example a new, small carrier might offer a 2 Mbps line for the price of major carrier's 64 kbps line. Potential increases in bandwidth of one to two orders of magnitude are attractive to a Department trying to maximise the bandwidth obtainable with a given budget.

The Department is always seeking additional bandwidth. VoIP services cannot be accommodated within the bandwidth limitations applying currently.

Private schools including Catholic schools currently make their own data service provision arrangements. It was thought that the Catholic schools in particular constituted a reasonably large and organised group that could quite probably achieve good pricing outcomes. The Department was open to view that there could be scope for further mutual benefits to be obtained from combined (i.e., public plus private) organisation and bargaining.

The largest problem faced by the Department is securing adequate coverage in regional areas. The CBD is well provided for. Gradually the geographic presence of the smaller carriers is increasing in NSW. Large bandwidth links to regional areas are presently available at reasonable prices but the tail connections remain expensive. The location of frame relay switches in regional areas would reduce connection costs to these links.

Victoria

Victorian telecommunications supply arrangements are subject to a general process of examination and enhancement through a co-ordinated government approach arranged by MultiMedia Victoria. The strategy known as *Connecting Victoria* commits the government to helping schools resource the information technology needs of their students and expanding IT training opportunities in the TAFE system and through VET provision in secondary schools. This is a very broadly based strategy that has connections with the Victorian, NSW and Queensland Tri-State Alliance on Regional Communications to pursue joint telecommunications initiatives.

The Telecommunications Purchasing Strategy (TPS), managed by Multimedia Victoria, delivers the option of whole-of-government pricing for telephony services to TAFE institutes and schools, but not to private VET providers and non-government schools. A new version of TPS called TPAMS (Telecommunications Purchasing and Management

Strategy) is currently being developed and will cover data networking and facilities management, as well as telephony.

The Department of Education, Employment and Training (DEET) has appointed a preferred supplier of Internet services. Most schools in Victoria use the preferred supplier but very few TAFE institutes do so. The Department is currently evaluating tenders for Internet services.

Data Services are required to be purchased from AAPT as the provider of the VicOne network managed by Multimedia Victoria. DEET funds the base VicOne link to all government schools. Base VicOne links range in bandwidth from 64kpbs to 2Mbps. For schools with ISDN connections, DEET funds an additional 64kpbs for schools having over 500 students and a further 64kpbs for schools with more than 1500 students. Schools can purchase additional data services from AAPT. DEET also fully funds VicOne links to 20 TAFE sites and 9 Adult Community Education sites, through the Office of Employment, Training and Tertiary Education.

One of the aims of establishing the VicOne network was to use the aggregation of demand across Government to maximise bandwidth and reduce costs. DEET was expecting cost reductions in the order of 25% in the first 12 months of the VicOne contract. However, actual reductions in the first 2.5 years of the contract were closer to 10%. There are anecdotal reports that other carriers are now offering lower prices than AAPT particularly in metropolitan and large regional areas.

Access to VicOne is available to private VET providers and non-government schools. The Catholic Education Office has negotiated access for Catholic schools and the Adult Community and Further Education Board has received a grant of approximately \$2 million from the Commonwealth Government's Networking the Nation Fund to improve ACE providers' access to the Internet including establishing links to VicOne for country ACE organisations.

Queensland

Presently the Department of Employment and Training has a single contract for the provision of all on-line services to all TAFE institutions. The provider was originally Ozemail, now UUNet, and was engaged for a 2+1 year period. Competition has strengthened since this arrangement was implemented and there are now expectations that when the current contract expires in September 2001 a number of institutions may wish to negotiate their own arrangements independently of centralised arrangements.

The Central Office of Education Queensland dictates most telecommunications provision arrangements in the secondary education sector. Services are provided by Telstra for the local loop and by panel supply for bundled long distance and other services. Because of a global State Government agreement with Optus to provide a fibre optic cable along the Queensland coast, Education Queensland is effectively required to use Optus to meet the State Government's agreed expenditure targets with that company.

All schools are provided with a basic 128 kbps service that is split 64+64 between curriculum and administration uses. Currently the 64 kbps curriculum service is provided under a one-year contract by Big Pond. Negotiated rates provide some level of discount to standard charges. In turn, the Central Office charges schools a monthly connection

fee and fixed rate per Mbyte. There are different recovery arrangements applying to self-managed schools and to non-self-managed schools.

Schools requiring additional bandwidth or seeking services unencumbered with firewall and strict filtering controls make their own arrangements. Some schools employ frame relay connections providing up to 2Mbps capacity. At the present time non-government schools do not have access to the Education Queensland arrangements. There is however some level of interest in their participating and some start up discussions exploring possible MOU arrangements are occurring.

Other one-on-one connection arrangements are entered into by some schools in the areas of data sharing and video conferencing. The Central Office provides a mandated checking role for all telecommunications contracts entered into to ensure service provision proceeds efficiently and as expected. The Central Office captures some of the benefits resulting from economies of scale in its negotiations with carriers but still experiences difficulties in obtaining satisfactory connection services in numerous isolated and remote areas of the State.

Western Australia

In Western Australia, all State Government agencies including education and training authorities (principally schools and TAFEs) procure basic telecommunications network services from carriers under the auspices of the Basic Telecommunications Services (BTS) and Statewide Telecommunications Enhancement Program (STEP) panel contracts. Unit prices are intended to be confidential and the same for all institutions, whether a large metropolitan TAFE or a small country school.

At present, government schools typically use a dial-on-demand ISDN data communications 64 kbps link to the Head Office for logging on to the corporate E-mail system and Website. Internet access is usually via ISDN at 64 or 128 kbps or via a 56 kbps dial-up modem to a local ISP. ADSL and satellite services (e.g., BigPond Advance) are used by a growing number of government, Catholic and private schools in Western Australia in metropolitan as well as rural and remote areas. A handful of schools have optic fibre connection to an ISP.

The Catholic Education Office (CEO, the umbrella organisation for catholic schools in Western Australia) and the Association for Independent Schools of Western Australia (AISWA) have secured entitlement to the beneficial prices offered via BTS and STEP. This has only happened recently and there has probably been little flow-through effect as yet. Catholic schools across Australia are already entitled to favourable pricing from Telstra under an existing contract.

The Education Department of Western Australia has evaluated responses to a recent Request for Proposal (RFP) for voice and data carrier services, remote access for teaching and administrative staff, specialised services to assist with educational delivery to Schools of the Air (i.e. very remote locations) and video teleconferencing. The RFP forms the basis for the development of the infrastructure component and is the first of a number of stages intended to streamline the acquisition and management of IT infrastructure in the Education Department. The Department is working collectively with the non-government schools (via the CEO and the AISWA) and respondents to the RFP were required to offer pricing and services to all schools (K-12) in the State.

Through the above RFP process, the Education Department received integrated solutions for a corporate-standard communications network that will be able to efficiently carry voice/data/Internet/video/remote access and School of the Air traffic at the required levels of functionality and security. Solutions will also cater (through the IP virtual private network that will eventuate) for the convergence of voice, fax, data and video. The key feature about the RFP was the volume and continuity of business over a designated contract term (up to 4 years).

As at May 2001, every educational institution in Western Australia makes its own arrangements for Internet access resulting in numerous suppliers and few economies of scale for the education sector as a whole. Nevertheless, the Department of Contract and Management Services has a centralised Internet facility (called ServiceNet) that offers whole-of-government rates and is used by some education institutions. Later in 2001, both the Education Department and the CEO are intending to go to the market for centralised Internet access for their respective schools systems.

South Australia

In South Australia the general position for VET provision by the TAFE sector is that most telecommunications services are covered by whole-of-government arrangements. Dealings are either mandated or directed. There is a possibility that this level of direction may be eased in the future with consideration being given to allowing SA Institutes of TAFE more independence in their operations. There is a view that allowing a greater degree of self governance might enable additional benefits to be realised.

For standard telephony services, State Systems provides all switchboard infrastructure but AAPT is the telephone network manager/supplier. Mobile telephony is provided by Optus. Use of Optus is mandatory.

For both data communications and video conferencing, Telstra is the only possible supplier because both networks are built on ISDN technologies. Terminal points on the data network are managed by the outsourced supplier EDS.

Internet service provision is via a wide area network with one access point for all the TAFE Institutes. The capacity of the link is 10 Mbps.

In the secondary education sector, similar whole-of-government arrangements apply. It was noted that the long distance telephony contract with AAPT has expired and now continues as an interim measure while new arrangements are under consideration. A current RFP seeks proposals for the supply of all telecommunications for all government agencies in conjunction with undertakings to develop telecommunications infrastructure in the State.

The RFP process envisages more than one provider, if possible, but not a panel period contract. South Australian experience is that panel period contracts do not allow for the exercise of adequate leverage in obtaining development and other benefits flowing from the consolidation of whole of government demand. The concluded whole-of-government arrangements will apply to schools and will also be available to non-government schools.

An earlier State Government economic development initiative led to a tied, education sector arrangement for the on-going supply of ISP services in country areas by Telstra.

Tasmania

Both the TAFE sector and the secondary education sector are mandated customers of Networking Tasmania which is a whole-of-government approach designed to bring new communications technologies and infrastructure to Tasmania earlier than might otherwise be the case. The approach reflects the special circumstances of Tasmania which has just one dominant telecommunications provider and smaller government agencies in smaller numbers.

The mandated Networking Tasmania arrangements have been negotiated centrally to capture benefits of all available potential economies of scale. The resulting savings are passed on to all users with a standard pricing structure based on size of link and distance. Non-government schools are able to access the same arrangements and a large majority, perhaps of the order of 80%, choose to do so.

Different arrangements apply to each of the main categories of service: data communications are provided by a fully managed service let out by tender; voice services are provided via a reselling arrangement and mobile telephony is about to be let in a third contract.

Data service provision occurs under a mandated Telstra five-year contract that has two years to run. Although service was considered by some to be poor a year ago there have since been substantial improvements with superior links put in place and lower prices. Currently 1 Mbps links are supplemented by 128 kbps links to more remote centres such as Queenstown and Smithton. The service comes as a package with both good and not so good features when viewed from the perspective of a particular usage requirement. Overall it is regarded as an acceptable package now, but some agencies would still consider that further improvement is required to reach desired standards of customer focus and service.

Telephony is provided by a Telstra value added intelligent network, TasiNet, that places the switch in telephone exchanges (this is an application of Telstra's Spectrum product). Overall, this is regarded as a satisfactory arrangement with call features and benefits that make the costs acceptable. It is delivered as a completely managed service. However, some institutions making a large number of local calls (that are time-charged in the network package) have opted out from TasiNet.

Australian Capital Territory

In the ACT, the Canberra Institute of Technology (CIT) is by far the largest provider of VET services. It operates from several campuses and uses a self-provided wide area network operating over relatively short distance microwave links. The CIT is considering using ADSL lines for more redundancy (i.e., reliability) and is also considering joining other rest-of-government arrangements depending on an investigation of costs, reliability and security. Under mandated government outsourcing provisions, the CIT is obliged to source some telecommunications services from the present IT supplier, IntACT. The procurement of ISP services remains a matter of free commercial choice. Currently the CIT obtains no special discounts for the service provided by Telstra Big Pond but market circumstances are likely to change as a new competitor, TransACT, roll outs broadband optic fibre services in Canberra over the next few years.

In the secondary education sector, all government schools are currently required to use the telecommunications services provided by IntACT. This includes the provision of a basic 64 kbps ISDN line used for administration purposes and for some smaller scale Internet connections. Some schools and all colleges use a 128 kbps link. The IT Services Branch of ACT Education and Community Services provides an ISP service to a large majority of government schools and also to some non-government schools. The service is a heavily filtered one and is competitively priced. For a variety of reasons, a number of schools also use additional ISP services supplied by other commercial providers. These services are obtained at independently negotiated rates, thought to be at or near full retail price levels.

All telephone services are provided through IntACT and reflect the benefits of whole-of-government negotiated rates, for example free local calls.

Non-government schools have been excluded from participating in the IntACT telecommunications supply arrangements with the exception of one application involving information exchange with the Board of Secondary School Studies concerning ACT Year 12 Certificate provision.

On 30 April 2001 the ACT Minister for Education announced that all government schools would be connected to the TransACT broadband fibre-optic network by the end of 2003. There is some uncertainty as to how the existing arrangements with IntACT will be replaced by the new arrangements with TransACT. The Minister also announced that under the TransACT deal non-government schools would be offered the opportunity to connect at the same discounted price as government schools.

Northern Territory

In the VET sector, in the Northern Territory there are no centralised arrangements applying to what are known locally as regional training organisations, either public or private. Each regional training organisation is responsible for its own telecommunications arrangements and costs. Regional training organisations in the Northern Territory are highly concentrated in the sense that the single largest represents more than half of the sector and the three largest, the great majority of the sector.

The situation is different in the secondary education sector where a project, Learning and Technology in Schools (LATIS), is expected to be implemented across the Northern Territory in July 2001. LATIS will deliver a mandatory centralised telecommunications framework for all schools, both government and non-government. The Association of Independent Schools and the Catholic Education Office have been involved in discussions from the commencement of the project and agreement on a general philosophical framework was reached at the outset. Optus will be the service provider. Optus is also the service provider for a distinct whole-of-government arrangement that extends to all government corporate offices but not to schools.

The telecommunications links provided under LATIS will be tailored to the circumstances applying at each school. Downloads will be provided by satellite at 512 or 400 kbps, with provision for ready upgrade to 1 Mbps. Back links will be via conventional dial up modem, ISDN, full duplex satellite connection or the use of community satellite links as appropriate.

The LATIS project was developed with particular regard to the different, developing environment that applies in the Northern Territory. In particular, the Territory needs to deliver services to a large geographic area occupied by only a small population, some 28% of which are non-urban aboriginal. The principal incentives were to achieve cost savings, achieve equity of access in remote areas and to deliver a standard telecommunications environment for integration purposes.

Some general observations

There is no clear model for State and Territory telecommunications provision to the VET and secondary education sectors. Differences start with varying departmental structures and responsibilities and grow with variations in the nature and complexity of delivering services to differently distributed populations. Additional varying historical, political and other factors also contribute to the resulting diversity of arrangements. Consequently, VET establishments in different jurisdictions operate under a widely varying array of guidelines and requirements, ranging from the almost non-existent to the highly centralised and mandated.

Some jurisdictions have common arrangements for the delivery of telecommunications services to both the VET and secondary education sectors while others have established arrangements tailored to specific requirements in each sector. In those jurisdictions where the VET and education sectors are administered separately, comparisons with the arrangements applying and being developed in the larger secondary education sector can be instructive. As always, such comparisons need to be mindful of the specific circumstances applying in each instance.

A continuously recurring feature of comments offered by the officials contacted was the importance of competition in the market place. Competition, however, tends to be most evident in areas with higher population. Large parts of Australia have yet to see much in the way of effective competition in the supply of telecommunications services. The clear result is that the more populous jurisdictions are advantaged in their ability to obtain attractive service delivery outcomes, as tend to be the more populous regions within any given jurisdiction. Although education providers located in small or remote communities do need to overcome higher costs of access, there were no instances mentioned by officials in which access to telecommunications and Internet services was not available at all.

The trade-offs between the benefits attainable from highly aggregated demand and the benefits attainable from specialisation and flexibility appear to suggest there are both economies and diseconomies of scale to consider. It seems likely that there are some thresholds relating to the size of total demand that could suggest the most appropriate approach to follow. Broadly, smaller markets might seek the highest level of demand aggregation they can muster, perhaps using whole-of-government arrangements, while larger markets might find they can achieve better tailored outcomes within the scale of their aggregated educational demand alone.

Clearly it seems important that care be taken to ensure that, as far as possible, any negotiated whole-of-government or whole-of-sector requirements do not operate in ways that could unduly constrain VET providers (and other agencies) from taking advantage of newly emerging market opportunities.

A number of jurisdictions reported successful arrangements involving the co-ordination and aggregation of telecommunications demand from both government and non-government education providers. The success of such arrangements would appear to commend the process to other jurisdictions, particularly where there exists some degree of commonality in educational goals and requirements.

Most jurisdictions indicated that their evolving experience combined with changes in technology, changes in competition, changes in broader government policies and changes in political outlook were all actively influencing their perceptions of what remained appropriate and in the best interests of education providers. In a majority of cases, this rapidly changing environment had led to jurisdictions actively seeking to implement changes in their existing arrangements, sometimes far reaching and quite major changes. There seem to be no grounds for believing that the pace and extent of prospective changes will slow.

Examples of important evolutionary trends with regard to telecommunications in the education and training sectors can be illustrated by the following two examples from Western Australia:

1. Through a complex RFP process conducted from January to May 2001, the Education Department of Western Australia received offers of integrated solutions with a capacity for efficient carriage of voice, data, Internet and video, as well as Remote Access and School of the Air traffic at the required levels of functionality and security. It will also cater (through the corporate-standard IP virtual private network that will eventuate) for the convergence of voice, fax, data and video. The key feature about the RFP was the volume and continuity of business over a designated contract term (up to 4 years) and the prices obtained should allow the Department to provide broadband (512 Kbps up to 2 Mbps) to regional schools and wideband (4 to 10 Mbps or greater) to metropolitan schools. A notable feature about the RFP was that tenderers were required to offer the same prices to Catholic schools and Independent Schools.
2. Following a complex RFP process conducted in 2000, Western Australia's largest TAFE institution — Central Metropolitan College of TAFE — entered into a 5-year contract with Ericsson Communications Networks to supply and manage a completely new telephone system with 34 Mbps microwave links joining its many campuses. The managed network allows business process re-engineering such as a state-of-the art call centre and one centralised group of telephone operators to answer calls for all campuses. Voice calls and videoconferencing sessions are carried 'free' on the data network. Central Metropolitan College of TAFE selects its carriers using a highly competitive whole-of-government panel and the contractor is required to provide the College with independent professional advice on the selection of carriers and other such matters.

4. The Survey

The survey was a major source of information for the study. Its main purpose was to obtain current information on:

- the range of telecommunications service providers supplying the educational and training sectors;
- the related supply arrangements and pricing structures; and
- differences in supply arrangements and prices that may exist between metropolitan, regional and remote areas and between the different educational and training sectors.

Objectives

The primary objective of the survey was to collect telecommunications cost information focusing on VET/ACE organisations and comparative information from schools and higher education institutions.

The provision of telecommunications services in the current competitive environment varies considerably between locations and between users. Competition is strongest in large markets such as exist in metropolitan centres. These markets are served by many competing carriers that vie to secure clients with attractive deals. Competition is less intense in regional centres and virtually nonexistent in rural and remote areas. As telecommunications services tend to be undifferentiated, the main form of competition between carriers is pricing. Where competition is intense, prices tend to be low. In particular, large customers are in a good position to negotiate attractive deals. This capacity to negotiate low prices has been used effectively by state governments in the development of 'whole-of-government' purchasing strategies and has benefited large educational users particularly in metropolitan areas. Much of the pricing information, however, is subject to commercial confidentiality provisions and is not available in the public domain.

The survey provides an insight into the availability of competitive suppliers and the pricing arrangements faced by educational and training institutions. By obtaining information from a range of large and small organisations located in different areas of the country, the survey is seen as an important tool in developing a map of differing arrangements and an understanding of the factors that contribute to them.

Survey sample size and responses

Consistent with the survey objectives, the survey sample frame was developed to ensure an adequate metropolitan and non-metropolitan representation in each State and Territory and an adequate representation of each of the educational sectors included in the survey. The distribution of sample units was designed to take account of the different institutional arrangements for the VET/ACE sectors in the States and Territories as well as the need to achieve an adequate representation of both large and smaller regional and remote areas.

Overall, the survey achieved a nominal national response rate of 35.9% calculated on the basis of the initial sample size. Eleven of the 326 establishments in the original sample,

however, could not be contacted either because of address changes or because the establishments had closed. Allowing for these 'non contacts' increases the effective national response rate to 36.2%. Responses were reasonably well distributed across States and Territories and within the regions. Tasmania was somewhat under-represented with only a 20.8 per cent nominal response rate (or 23.8 per cent effective response rate). The highest response rate was achieved in the Northern Territory (66.7 per cent both nominal and effective). There were some variations in the response rates within the regions in each State, but nationally these variations have broadly cancelled out. Details of the geographic distribution of the sample and responses are provided in Table 7.

Table 7: Aggregate Nominal Sampling Frame and Responses^a

	Metropolitan	Larger Regional	Other ^b	Total
NSW	32 (9)	21 (7)	11 (5)	64 (21)
Vic	30 (10)	18 (6)	12 (5)	60 (21)
Qld	20 (6)	20 (3)	10 (5)	50 (14)
WA	20 (6)	20 (4)	12 (6)	52 (16)
SA	20 (12)	13 (6)	12 (5)	45 (23)
Tas	12 (1)	7(3)	5 (1)	24 (5)
ACT	16 (4)	—	—	16 (4)
NT	10 (5)	-	5 (5)	15 (10)
Total	160 (53)	99 (29)	67 (32)	326 ^c (114)

Notes: a: Numbers in brackets are responses
 b: Includes Rural and Remote Locations
 c: Includes 11 'no contacts' because of address changes or closure of organisations.

In terms of institutional coverage, nominal response rates varied from 27.5% for schools to 55.3% for TAFEs. The corresponding effective response rates were 28.4% and 63.6%. The eleven establishments that could not be contacted comprised two schools that had been closed down, five VET providers and four ACE providers. The institutional distribution of the sample and nominal response rate is detailed in Table 8.

Table 8: Survey — Institutional Distribution

Type of institution	Nominal Sample	Responses
University ^a	16	8
TAFE	38	21
VET(Private)	109	37
ACE	94	29
High Schools	69	19
Total	326^b	114

Notes: a: Includes University Institutes.
 b: Includes 11 'no contacts' because of address changes or closure of organisations.

Sources of information

Several sources were used to identify organisations for inclusion in the survey sample. The most important of these was the directory of registered training organisations (RTOs)

maintained by the National Training Information Service (NTIS). Separate listings are maintained for each State and Territory. This identified a large number of high schools, private training organisations and ACE institutions providing VET courses and training. The coverage varies from state to state, particularly with respect to ACE organisations. This listing was supplemented with information from directories of educational organisations and from other sources including publicly available listings of schools, TAFEs and Universities maintained by educational authorities; listings of ACE organisations and membership lists of associations operating in the sector.

The definition of RTOs listed in the NTIS directory is quite broad and includes many entries that relate to in-house training provided by large organisations and a variety of 'consultants' and other private trainers providing a range of training services. As the focus of the study was on organisations with a primary interest in the provision of training, RTOs not conducting national accredited training courses were excluded from the potential population from which the sample was drawn. The sample was selected via a stratified random process from the reduced listing to achieve the predetermined sampling frame targets for each state and territory in terms of geographic location and type of institution. More details of the process used to identify potential survey respondents are provided in the Appendix 2.

The survey questionnaire

The survey questionnaire reflects the survey objectives. It comprises three main sections. The first section seeks details of the type, size (number of students) and location of institution responding to the survey. Contact details were also sought to facilitate any necessary follow up of respondents. The second section seeks information on the suppliers of telecommunications and Internet services to the respondent organisations as well as potential alternative suppliers. The third section is concerned with obtaining details of prices paid for the various telecommunications and Internet services consumed by respondents. The survey questionnaire is reproduced in Appendix 2.

The questionnaire was pre-tested in a pilot survey of educational institutions in Canberra and Perth to determine its workability (December 2000). The pilot test did not identify any significant problems with the wording and structure of the questionnaire and only minor refinements were made in the light of information obtained in the pilot survey.

Survey administration

The survey questionnaire was produced in both hard copy and electronic format for distribution to organisations included in the sample. Initially, hard copies of the questionnaire were sent only to organisations for which an email address was not available or the email address used was found to be inoperable. All others received the questionnaire by email. In either case, the questionnaire was addressed to the designated VET contact obtained from the NTIS listing or to the principal/chief executive if a designated contact was not available. Responses could be made via prepaid return mail, fax or email. A dedicated email address was established for electronic lodgement of completed survey questionnaires.

It had been hoped that the ease of responding by email would enhance response rates. This, however, proved not to be the case, possibly for a number of reasons. Although

email is easy to use and is rapidly becoming a major communication medium, unsolicited e-mails are often viewed with suspicion. Some are discarded without being read because the recipient might not be predisposed to answering a survey or for fear the email and any attachments might contain a virus. Another possibility is that the email might be opened and retained in an 'electronic post box' along with many other messages where it is not readily distinguishable for later follow up, even though there might well have been an original intention to do so. Some respondents also suggested that while many people might be confident in using email for the exchange of simple messages, they could tend to shun more complex uses.

The poor response rate achieved from the original email distribution of the questionnaire is not without precedent. Anecdotal information suggests that email surveys typically achieve response rates of less than five per cent. In this instance it had been hoped that because of the 'educational' focus of the survey sample, respondents might have been more favourably disposed towards responding to the email-based questionnaire. When it became clear this was not to be the case (the survey had only achieved a response rate of approximately eight per cent), all non-respondents were issued with a hard copy of the questionnaire through the post. In addition, some two weeks after the mailing of the postal questionnaire, when the response rate had increased to approximately 17 per cent, all outstanding non-respondents were contacted by telephone and asked whether they were intending to respond. These calls were intended as a polite reminder mechanism rather than to put pressure on organisations to respond. Discussion of the questionnaire and of the purpose of the survey was entered into only when initiated by those contacted. In some cases, the issue of a new questionnaire was requested by the contact.

With the aid of these measures a final effective response rate of 36.2 per cent was achieved. Such a response rate is at the upper end of the range typical for mail-based surveys.

Analysis of survey data

As indicated above, the survey focused on the collection of information to:

- identify current telecommunications and Internet service providers to the education and training sector;
- identify other potential service providers; and
- obtain details of current pricing structures.

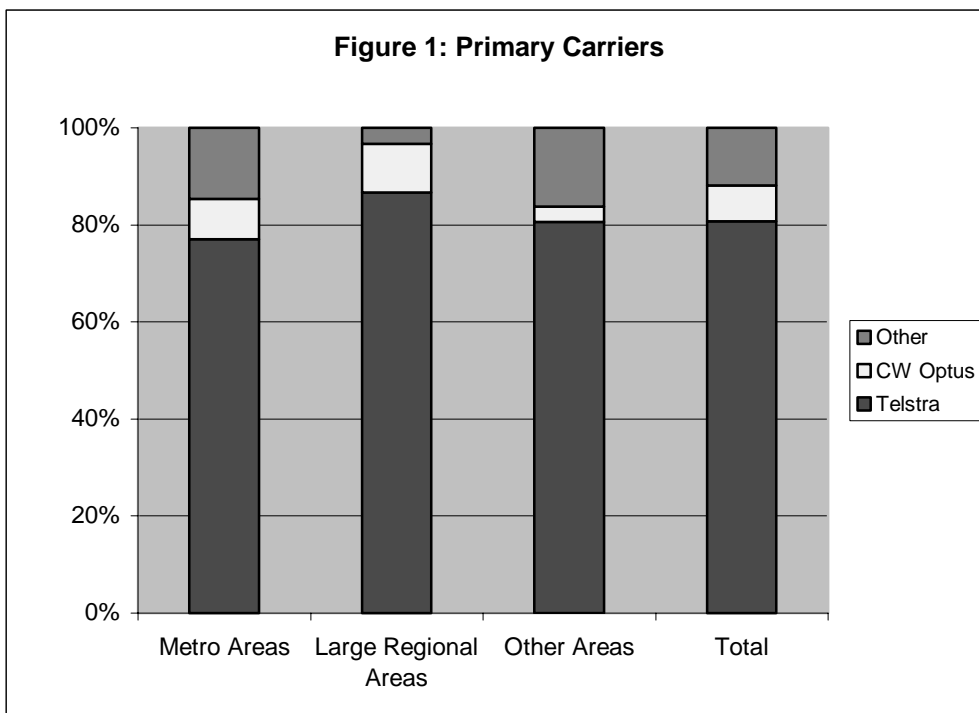
The survey findings are discussed in the next three chapters of the report. Chapter 5 discusses the competitive provision of telecommunications services to the education and training sector. It identifies current and potential service providers and other competition related factors. Chapter 6 details the nature and level of telecommunications expenditure by the education and training providers. The information collected in the survey is used to build typical expenditure profiles for each of the sub-sectors of interest to the study. Variations in the ruling prices for telecommunications services faced by education and training providers are then discussed in Chapter 7.

5. Supply of Telecommunications Services to Education and Training Providers

Current service providers

The survey collected information on current service providers to the education sector in each state and territory. Participants in the survey were identified in terms of the sub-sector in which they operated, their location in terms of broad regions within a state or territory and their size in terms of student numbers.

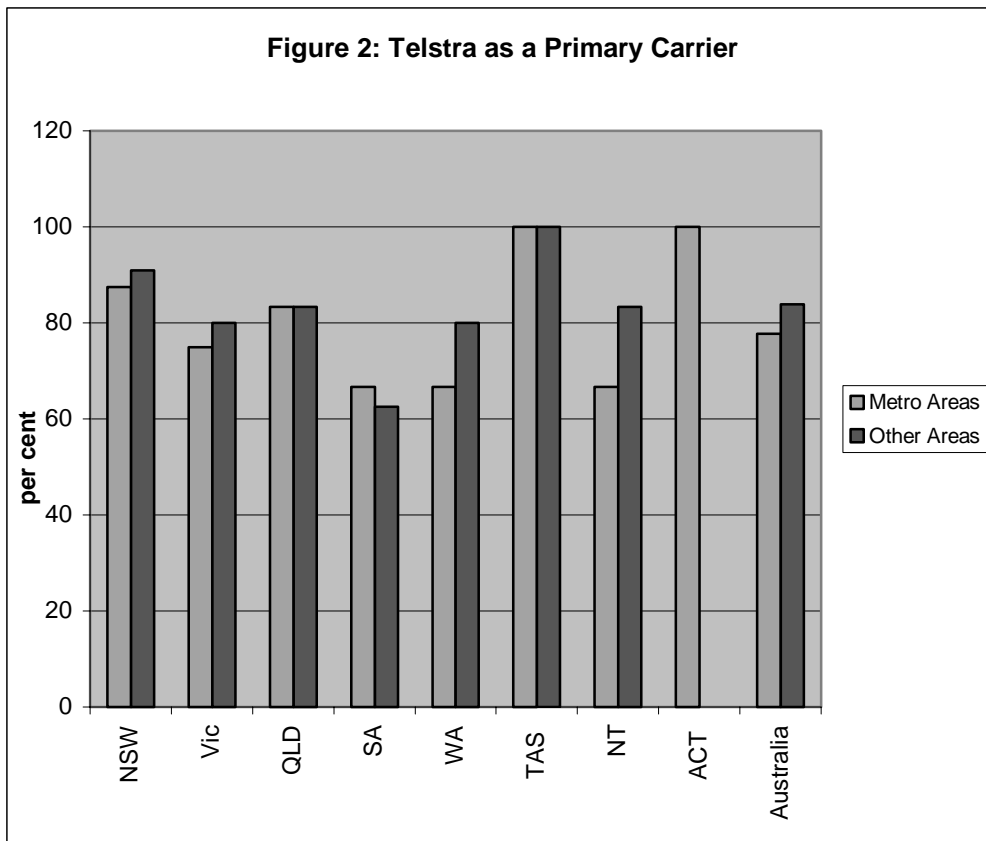
The survey elicited information on the current primary and secondary telecommunications carriers used by respondents as well as on the availability of alternative carriers. It also elicited information on the Internet service providers used by the respondents and the availability of other service providers accessible to the respondents at local call rates.



Details of the telecommunications carriers used by education and training providers are provided in Figure 1. The dominant position of Telstra as a supplier of fixed telecommunications services in the national market was reflected in the survey which found that Telstra was the primary carrier predominantly used by educational organisations with only slight variations from region to region. Overall, over 80 per cent of respondent used Telstra as their primary carrier (see Figure 1 for details). The proportion was lowest in metropolitan areas (77.1 per cent) and highest in large regional centres

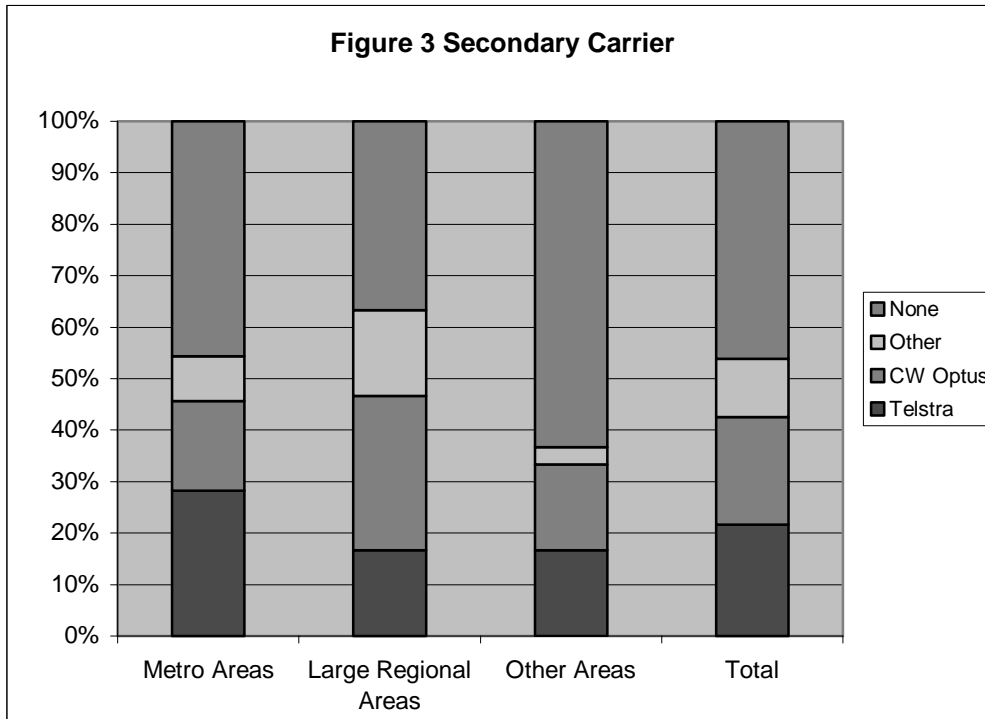
(86.7 per cent). Optus accounted for 7.2 per cent overall and its customers were located mainly in metropolitan and large regional centres. Other carriers², among which AAPT was the most prominent, accounted for 11.9 per cent.

A similar pattern was evident on a State/Territory basis with Telstra again being the primary carrier in all metropolitan and non-metropolitan areas. Details are provided in Figure 2.



More than half (53.7 per cent) of the respondents used a secondary carrier to supply some of their telecommunications services. Respondents in small regional and remote areas were the least likely (43.3 per cent) to use a secondary carrier for some of their services. Optus and AAPT appear to have a significant presence as secondary carriers in metropolitan and regional areas. Some of the large institutions consuming a broad range of services tended to use different carriers for different services. For example, a metropolitan university in the sample uses Telstra for outgoing telephone calls, Optus for incoming 'freecall' services and a third carrier for data services. Several of the smaller institutions use a different carrier for fixed and mobile services.

² Of the carriers included in this group, AAPT, Primus, OneTel and PowerTel were specifically identified in the questionnaire.



Mandated choice of carrier

As discussed in Chapter 3, some State and Territory Governments have specific policies for the purchase of telecommunications services from carriers. These typically mandate the use of specific carriers or a panel of carriers for the delivery of services to publicly owned institutions such as schools. Such arrangements are common for data services but are less common for voice services (fixed or mobile). The private VET sector and the ACE sectors, dominated by small independent organisations, are by their very nature largely independent in their choice of carriers and very few respondents in those categories reported the existence of central office policies mandating the use of a specific carrier. Overall, the survey found that the choice of carriers was mandated by departmental/central office policy for 28.7 per cent of all respondents. For particular sectors, a mandated carrier policy was reported by 62.5 per cent of responding universities, 57.1 per cent of responding TAFEs and 35.3 per cent of responding schools.

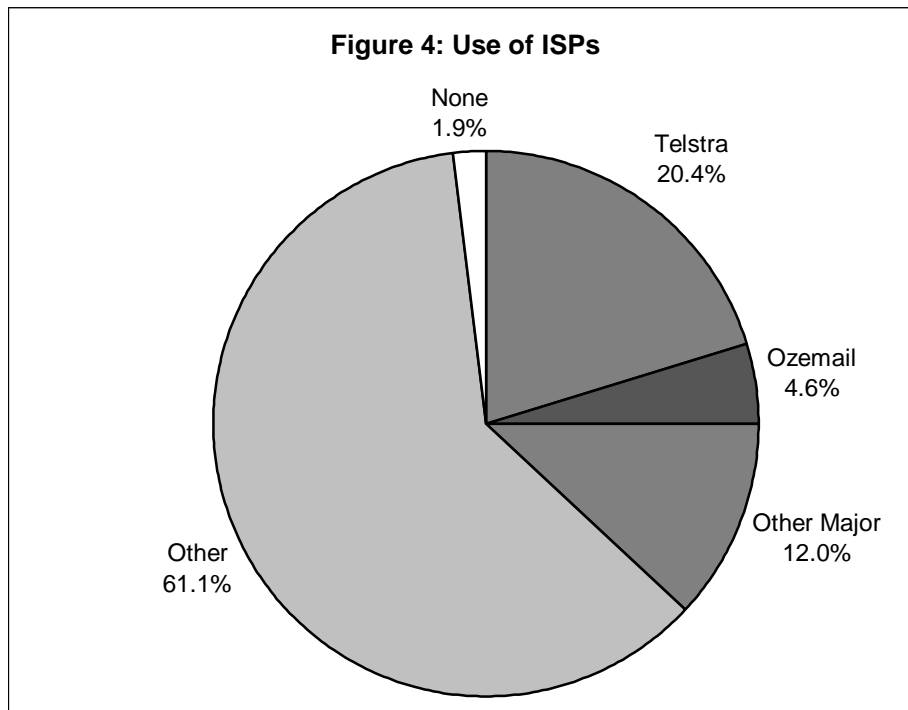
Availability of other carriers

Overall, 82.3 per cent of respondents indicated that carriers other than those used by them were operating in their area. However, whether this was the case for a full range of services is not known. The likelihood is that fixed telecommunications services in many smaller regional and remote areas are available only on Telstra's infrastructure either directly from Telstra or through other carriers reselling Telstra services. Competitive mobile carriers may also have been identified as alternative carriers in response to this question. It is interesting, however, to note that overall 7.7 per cent of respondents

indicated that either alternative carriers were not available in their areas or they did not know whether there were any such carriers. In either case, such responses suggest little, if any, effective competition for the supply of services. Those responses were primarily from smaller regional and remote areas. Over one third of respondents in those areas reported that either no alternative suppliers were available (20.8 per cent) or they did not know whether others suppliers were available (13.4 per cent).

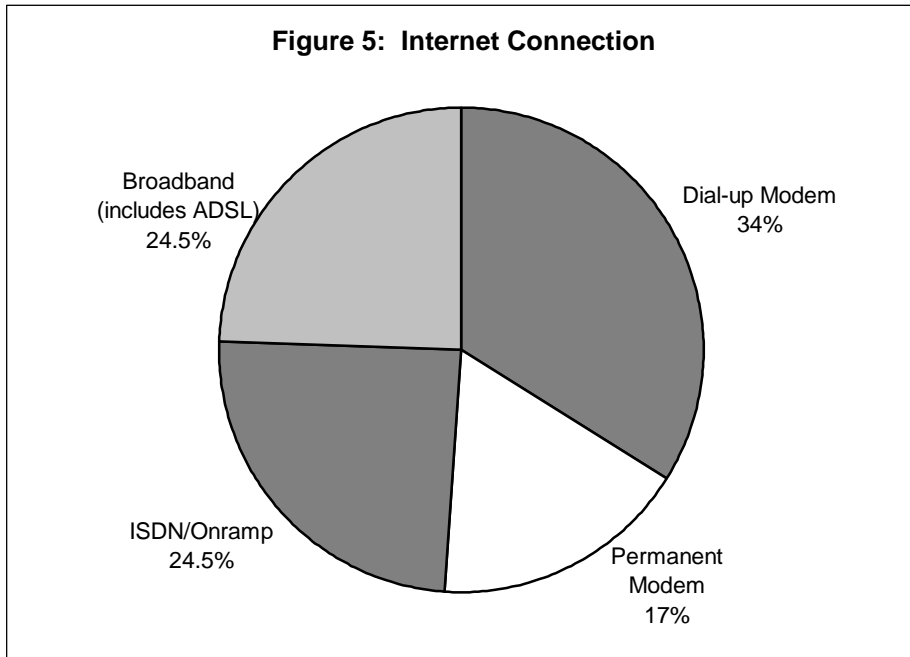
Internet services

The large number of competitive Internet Service Providers (ISPs) available in many parts of the country is reflected in the responses to the survey. Although Telstra BigPond was the most frequently identified ISP by respondents, it was used by only approximately 20 per cent of educational and training organisations. OzEmail was the second most frequently identified large ISP, but it was used by less than five per cent of respondents. The other eight major ISP providers (OptusNet, Primus, AOL, iPrimus, Connect.com, Westnet, Net-tech and Eisa), each separately identified in the survey questionnaire were used by an aggregate of only 12 per cent of respondents. Other unidentified ISPs were used by over 61 per cent of respondents. The details are summarised in Figure 4.

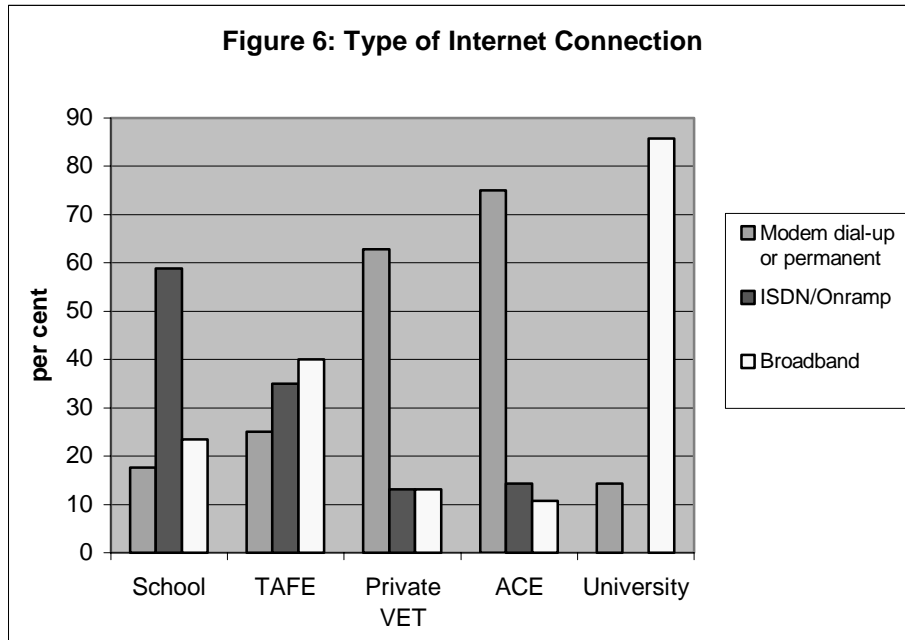


Overall, less than eight per cent of respondents reported that alternative ISPs accessible at untimed local call rates were not available in their area. Again, these respondents were concentrated in smaller regional and remote areas (where they comprised

approximately 17.2 per cent of respondents³). Those reporting the unavailability of alternative local call ISPs were located in small regional and remote areas of New South Wales, South Australia, Western Australia and Tasmania.

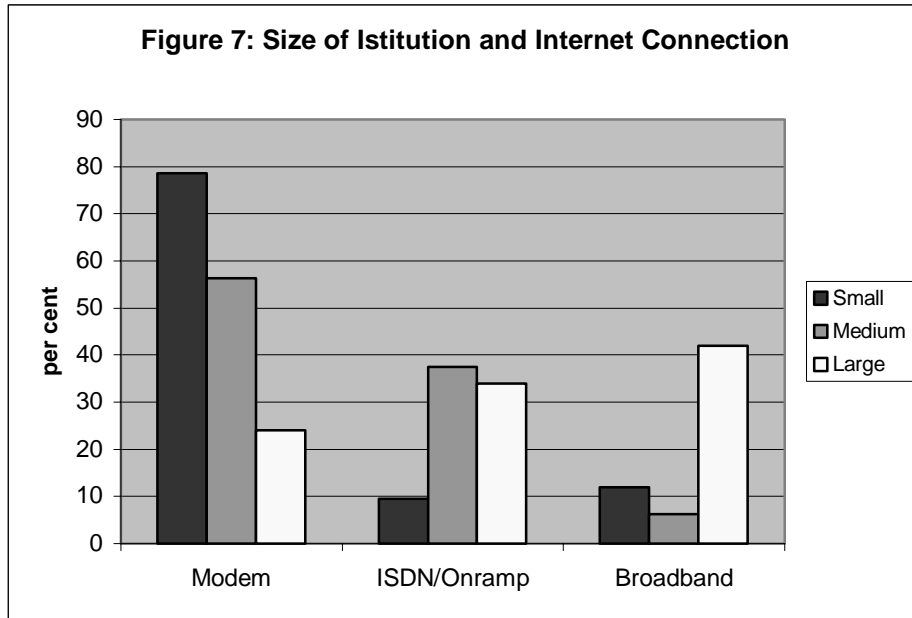


³ Because of limited responses to this question the figure should be treated as an indicative only.



The survey also obtained details of the type of Internet connection used by respondents. Details are provided in Figures 5 and 6. There were appreciable differences evident between the different types of education and training institutions. A dial-up modem was the means most used to obtain an Internet connection and was reported by 35 per cent of respondents. Dial-up modems, however, were much more likely to be used by ACE organisations (64 per cent) and Private VET providers (38 per cent). An additional 10 per cent of ACE organisations and 32 per cent of Private VET providers reported the use of a permanent modem connection. ISDN/OnRamp access was most frequently reported by schools (59 per cent) and broadband connections were more likely to be found in Universities (86 per cent) followed by TAFEs (40 per cent).

The type of Internet connection would be expected to be correlated with the level of use which in turn is likely to be related to the size and nature of the organisation. The survey used student numbers as a measure of the size of training and educational organisations. Respondents were classified into three groups, namely small (less than 300 students), medium (300 to 700 students) and large (more than 700 students). As would be expected, the larger institutions were more likely to use larger bandwidth connections. Details are provided in Figure 7. Without exception, the broadband connections reported by smaller organisations were ADSL.

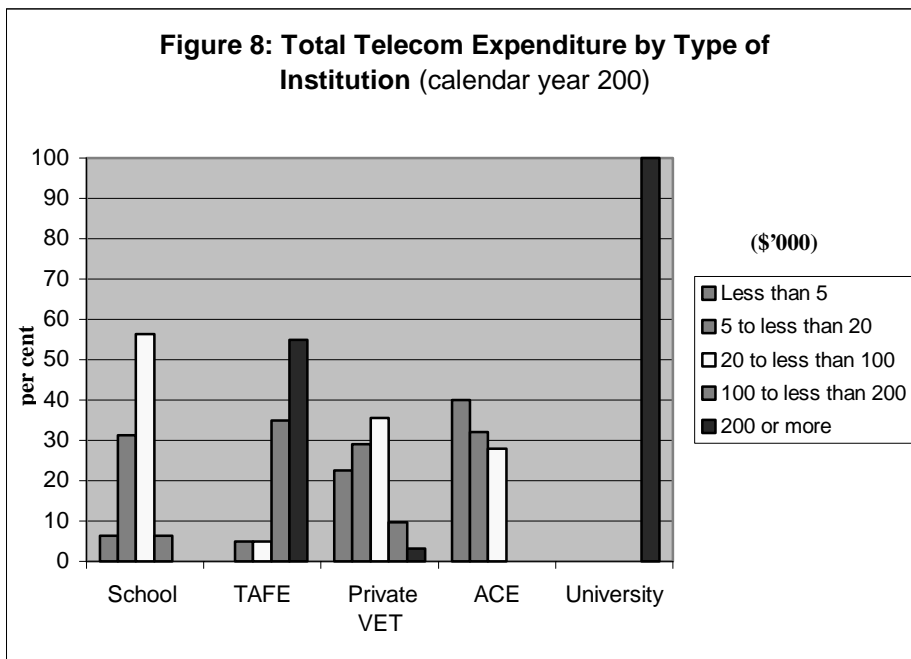


Modems (dial-up or permanent) were the primary means of obtaining an Internet connection in small regional and remote areas. Modems accounted for 68 per cent of all Internet connections of education and training providers in those areas. The corresponding proportion in metropolitan and larger regional areas was approximately 45 per cent.

6. Telecommunications Expenditure

Aggregate expenditure

Most of the education and training organisations covered by the survey incur considerable telecommunications expenditure relative to their size. In calendar year 2000, telecommunications expenditures ranged from less than \$1,000 for a small community education organisation to over \$1.5 million for large universities. The median expenditure was \$27,780. Over 16 per cent spent more than \$300,000 and approximately eight per cent spent over \$1 million. Reflecting their typical size, ACE organisations were much more likely than other institutions to have relatively low expenditures on telecommunications, followed by Private VET providers. Details are provided in Figure 8.



Expenditure on access lines

The survey collected information from respondents on the main components of their telecommunications expenditure including the cost of access to services (rental of telephone and fax lines; leasing of data lines) and the cost of using services. The cost of obtaining access to telephone and fax lines is a relatively substantial proportion of total telecommunications costs for all the groups included in the survey. The cost increases with the number of lines used, which, in turn, is related to the size of the organisation. On the basis of the expenditure quoted by respondents, very few of the organisations surveyed had only one or two telephone/fax lines. Multiple lines were common even among small institutions. Reflecting their size, approximately 40 per cent of respondents spent less than \$5,000 on telephone and fax lines in calendar year 2000 and over 15 per cent spent more than \$100,000. Expenditure on telephone and fax lines ranged from a low of \$260 to \$800,000. Figure 9 provides details of the distribution of respondents on the basis of their annual expenditure on telephone and fax lines.

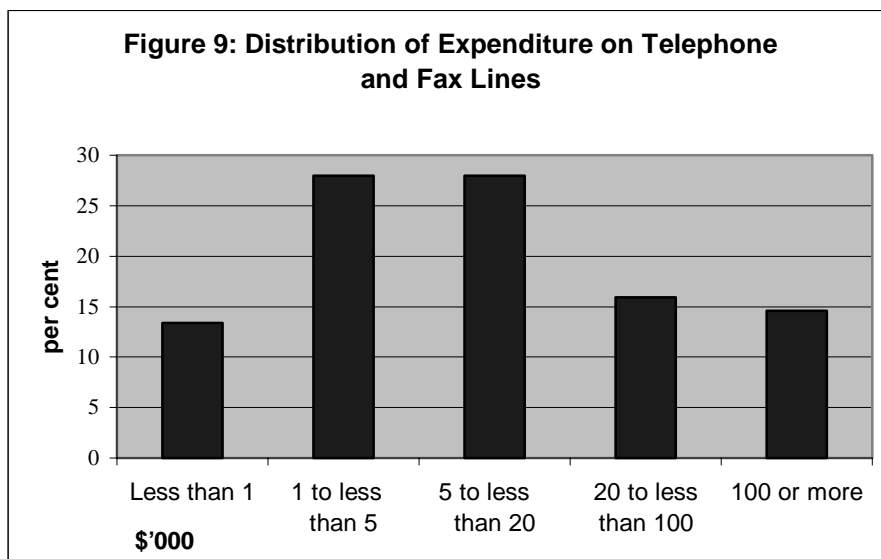
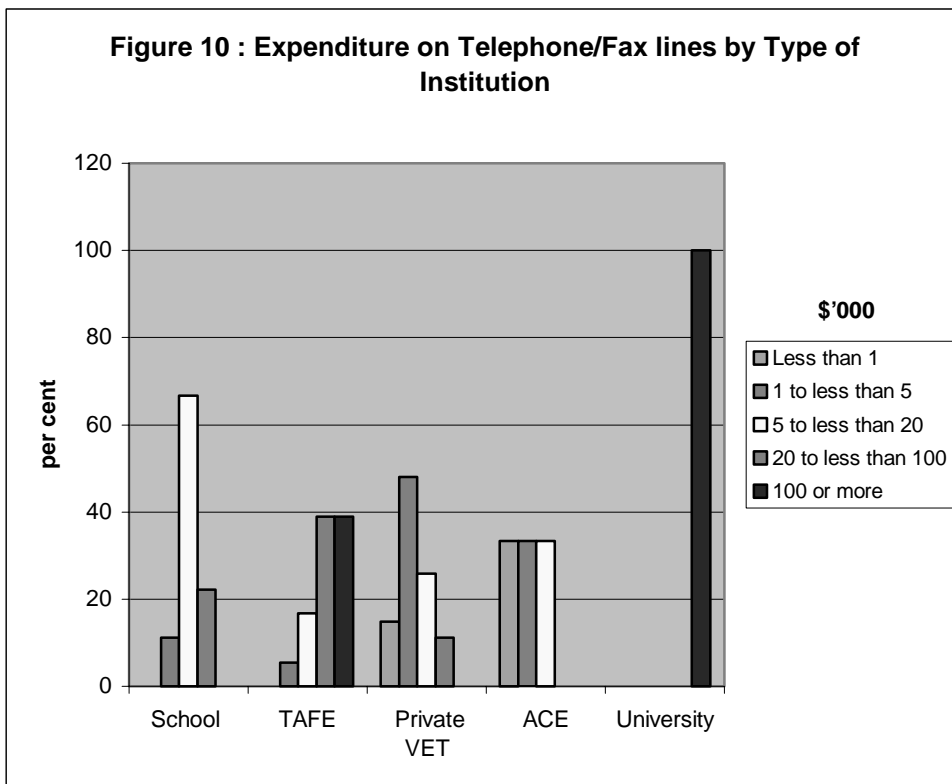
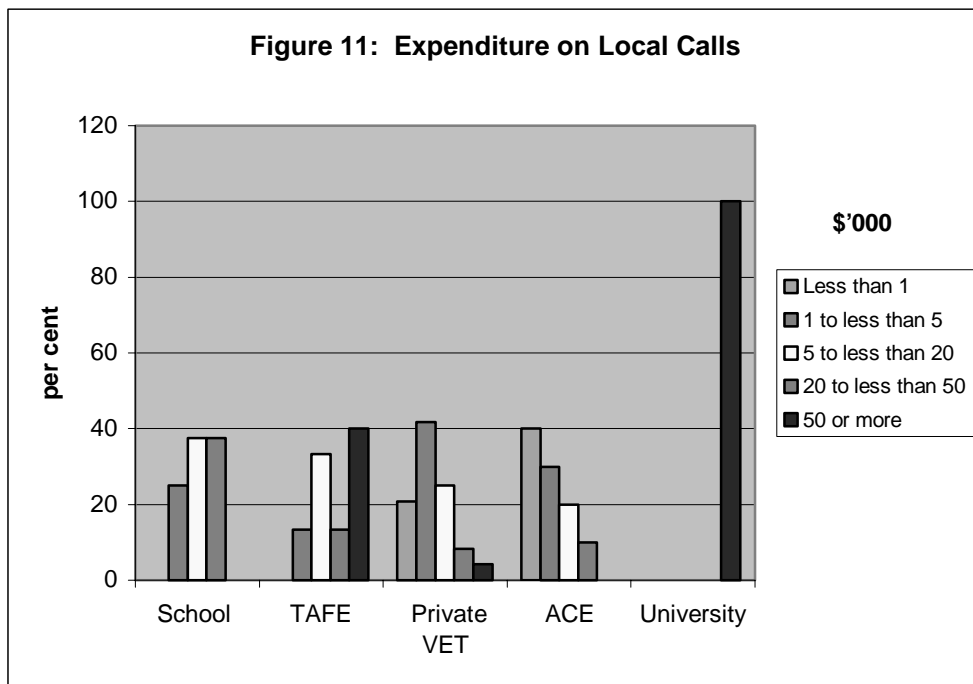


Figure 10 provides details of the relative distribution of annual expenditure on telephone and fax lines for the various educational categories used in the survey. This provides an indication of the typical expenditure of institutions or organisations within each sector. For example, the figure shows that a typical expenditure on telephone and fax lines by a school is in the range of \$5,000 to \$20,000 per annum, while that of a TAFE is typically much higher, often around \$100,000 or more, reflecting a greater use of telecommunications services. Small organisations in the Private VET and ACE sectors seldom spend significantly more than \$5,000 per annum on telephone and fax lines.



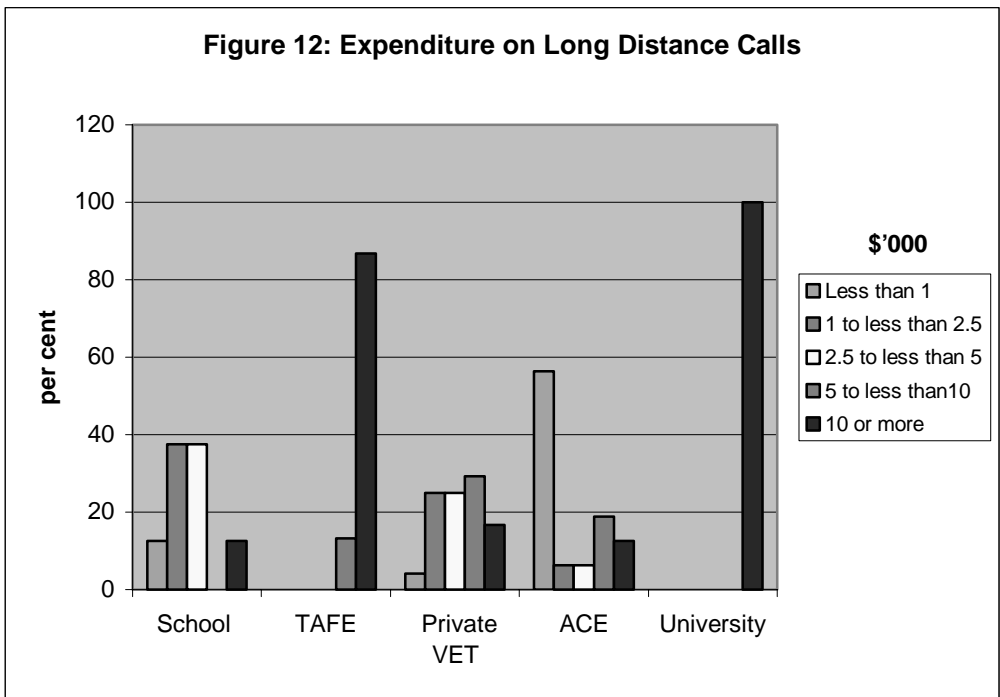
Expenditure on local calls

Expenditure on local calls varies considerably within each sector and tends to be related primarily to the size of the organisation (see Figure 11 for details). This is particularly evident for schools, most of which had student enrolments between 300 and 700, and TAFEs with enrolments of more than 700 (in most cases). The expenditure of Private VET and ACE organisations is skewed towards the lower end of the scale reflecting their smaller size.



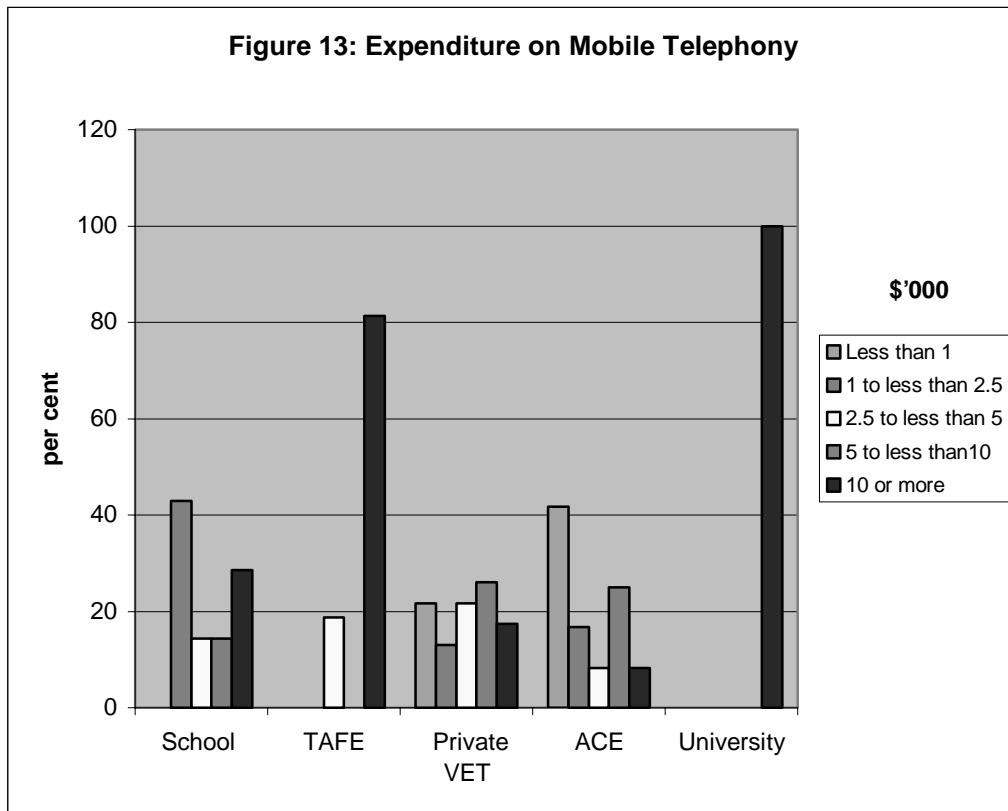
Expenditure on long distance calls

Expenditure on long distance calls also appears to be related to the size and nature of the organisations in the survey. Typically, schools, reflecting their local focus, spend relatively low amounts on long distance calls. TAFE's and Universities, on the other hand, incur relatively substantial expenditure on long distance calls. Details are provided in Figure 12.



Expenditure on mobile telephony

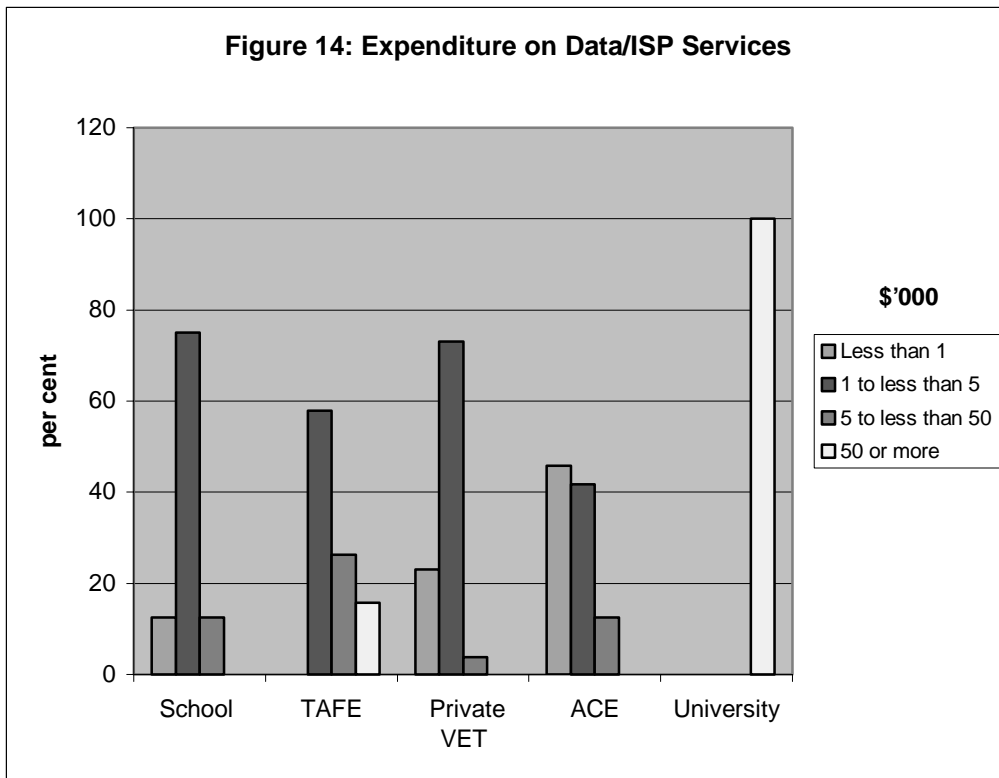
Mobile telephony expenditure (see Figure 13) has a similar pattern to expenditure on long distance calls. The distribution of expenditure among organisations in the Private VET and ACE sectors should be interpreted with some caution as it is affected by the relatively small number of respondents in some of the expenditure ranges. For both groups, reported annual expenditures of \$10,000 or more, were always close to the lower end of that range. In contrast, the expenditure on mobile calls reported by TAFEs and Universities was well above \$10,000 per annum in most cases.



Expenditure on data communications

Expenditure on data communications including Internet access varies considerably with the importance and uses of those services by the organisations in the survey. It should be noted that Internet expenditure essentially includes two components, connection costs paid to a carrier for a communications link to an ISP, and Internet access and usage costs paid to the ISP. These are not always separated in customer billing. Additionally some ISP's charges are based on volume (i.e., the number of Megabytes downloaded per month) and others are based on access time (i.e., the number of hours connected per month).

Although the survey questionnaire sought to differentiate between these typical arrangements, the returns suggest that respondents had some difficulty in differentiating and classifying their expenditure. These difficulties reduced the number of useable responses with the result that the details provided in Figure 14 are indicative only and should be interpreted with some caution.



Those reporting annual expenditure of more than \$5,000 for data/ISP services were all receiving services via an ISDN (29 per cent) or broadband connection (71 per cent). The vast majority of those with a broadband connection were TAFEs and Universities. Those receiving services via a modem rarely reported data/ISDN costs of more than \$5,000.

Telecommunications expenditure profiles

The expenditure data collected in the survey enables the construction of typical expenditure profiles for institutions and organisations in each of the sectors. The profiles rely primarily on the average expenditure in each category by institutions or organisations in each of the five sectors covered by the survey. To ensure that the average is not unduly distorted by either very large or very low expenditure by one or a small number of respondents, the average was compared to the expenditure of the median respondent for each category. Where the median and average differed considerably, the 'typical' expenditure was estimated with reference to the distribution of the responses. The typical expenditure profiles by type of institution or organisation are provided in Table 9 and in Figures 15 to 19.

Table 9: Typical Telecommunications Expenditure (\$'000)

	Telephone/ Fax Lines	Local Calls	Long Distance Calls	Mobile Calls	Data/ISP	Other (incl. maintenance)	Total
ACE	2.5	3.5	1.5	2	1	0.3	10.8
Secondary School	12	12	3	5	5	1	38
Private VET	3	3.5	5	4	3	0.6	19.1
TAFE	70	45	35	30	50	30	260
University	110	80	55	50	75	50	420

Figure 15: Typical Telecommunications Expenditure ACE Provider

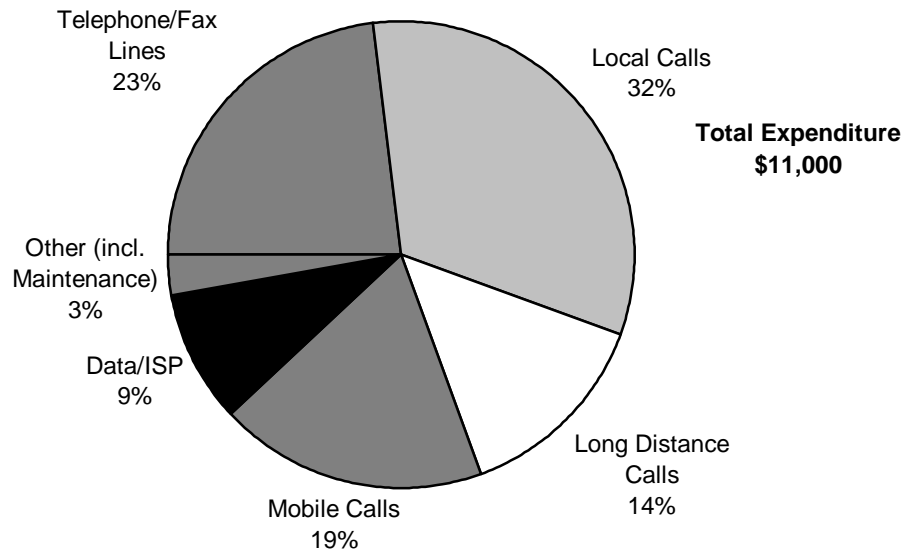
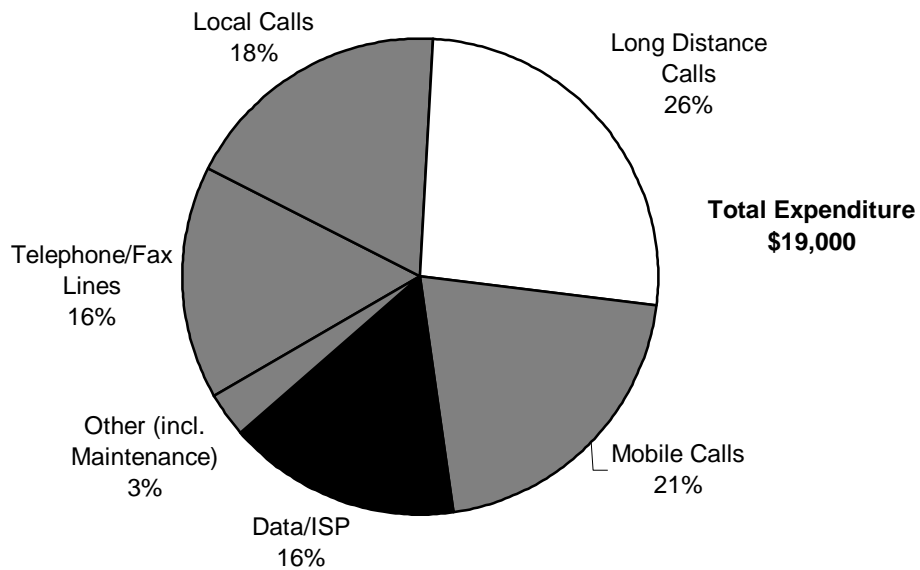
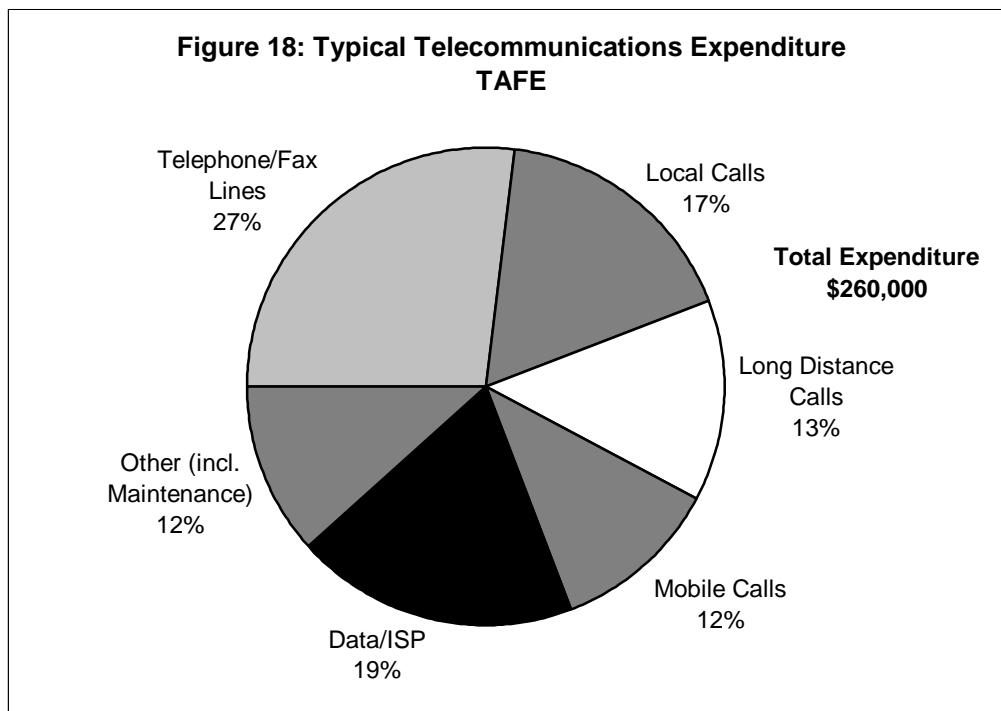
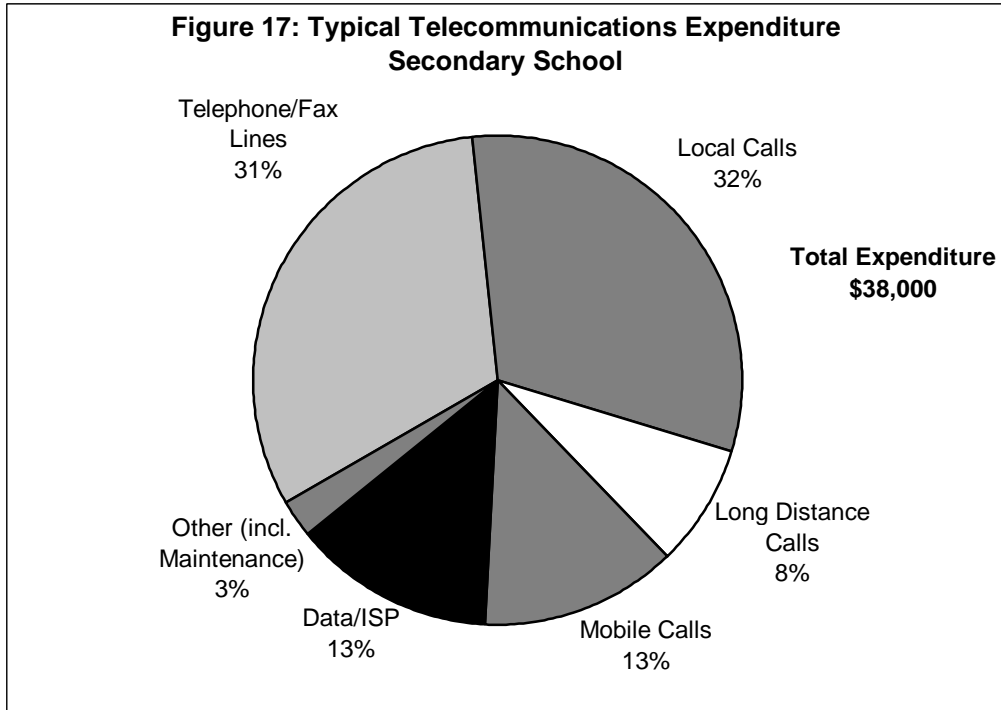
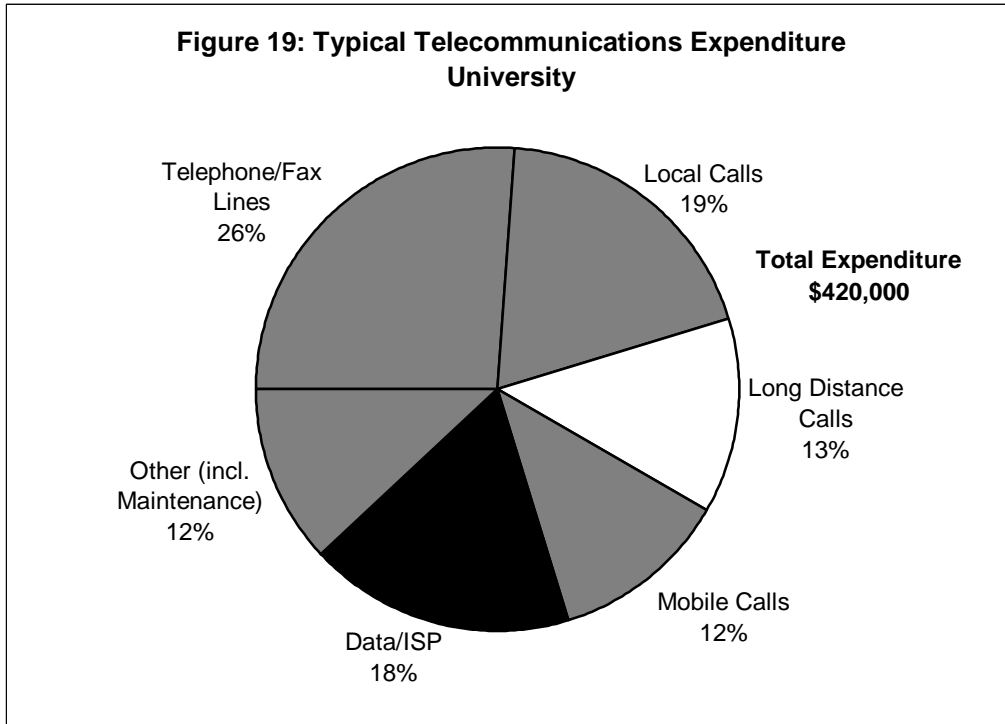


Figure 16: Typical Telecommunications Expenditure Private VET Provider







7. Prices of Telecommunications Services

A major aim of the survey was to obtain information on the prices paid for telecommunications services by education and training providers and how prices differ between sectors and between metropolitan and other areas. The survey collected unit price information for major telecommunications services including telephone/fax access lines, local calls, mobile calls, data lines and ISP services. Some of the unit prices varied little between sectors and between metropolitan and other areas, although prices in metropolitan areas tended to be consistently lower than in other areas. As basic telecommunications services (for example, access lines and local calls) are subject to price control regulations, this is not surprising. For services subject to price control regulation, there was also little variation between sectors, although TAFEs and Universities consistently reported better than average prices reflecting their relatively greater purchasing power and their typical location in larger centres. The differences are most clearly evident when prices paid for services are compared on the basis of the enrolment-size of the respondents. For services not subject to price controls, variations between sectors were more evident.

Average prices per unit of service

The average prices per unit of service paid by education and training providers covered by the survey are shown in Table 10. The information in the table relating to data lines and ISP services is not directly comparable between the sectors as it does not distinguish between the capacity of the lines. The lower average prices paid by VET providers and ACE organisations generally relates to their use of lower capacity lines. It should be recalled that very few such establishments reported having an ISDN or a broadband connection (see Figure 6 above). Where services are comparable, particularly for local and mobile phone calls, the table clearly shows the ability of Universities to secure better deals than other organisations. The TAFE sector also demonstrates some ability to secure advantageous pricing from suppliers.

Table 10: Average Unit Cost of Telecommunications Services by Sector

	Tel/Fax Line ^a (\$)	Local Calls (cents)	Mobile Calls Daytime (cents/min)	Data/Private Line ^b (\$)	ISP Access (\$/hour)	ISP Access ^c (\$/month)
ACE	34.1	20.7	102.1	365	1.46	151
Secondary School	36.7	19.6	58.9	327	1.98	298
Private VET	29.3	19.5	77.6	720	--	400
TAFE	37.1	18.8	56.1	652	--	2161
University	38.0	16.0	42.7	1101	d	d

- Notes: a: Includes service and equipment.
 b: Does not take account of line capacity.
 c: Does not take account of connection capacity.
 d: Universities are members of AARNET (a not for profit company licensed as a carrier) that supplies wideband ISP access at highly favourable, but commercially sensitive (undisclosed) rates.

Prices and enrolment size

The greater capacity of the larger institutions to secure better prices than others is generally supported by the information provided in Table 11. The table shows the unit costs of respondents grouped on the basis of their enrolment size. Generally the larger the size of the institution, the lower the unit price paid for services. The apparent higher price for local calls paid by organisations with an enrolment between 300-700 is somewhat anomalous and is difficult to explain fully from the survey information. To some degree, however, it is likely to be due to an over-representation of private VET and ACE organisations in that group of respondents. The average unit price for data lines and monthly ISP access reflects the earlier observation that the lower per unit costs paid by VET and ACE providers for those services is related to the capacity of the lines and services that are consumed. Smaller institutions tend to have lower demand for data/Internet services and are more likely to use lower capacity data lines and Internet connections.

Table 11: Average Unit Cost of Telecommunications Services by Enrolment Size

	Tel/Fax Line ^a (\$)	Local Calls (cents)	Mobile Calls Daytime (cents/min)	Data/Private Line ^b (\$)	ISP Access (\$/hour)	ISP Access ^c (\$/month)
Less than 300	37.6	19.3	81.4	411	1.66	208
300-700	35.6	21.3	74.0	--	2.10 ^d	278
Over 700	33.9	18.8	57.5	783	1.83 ^d	1163

Notes: a: Includes service and equipment.
 b: Does not take account of line capacity.
 c: Does not take account of connection capacity.
 d: Limited number of responses.

Regional price variations

The survey collected details of the geographic location of respondents. This information was cross-tabulated with information on the prices paid for services to provide information on price variations between regions. While consideration of regional differences at the national level was possible, the limited size of the survey sample precluded detailed analysis of differences between States and Territories. When responses are subdivided on a State and Territory basis small cell sizes quickly became evident and posed particular problems for the derivation of useful conclusions. This was largely anticipated in the design of the study and was the primary reason for the collection of information on telecommunications structures and pricing from officials in central offices of relevant State and Territory agencies (see Chapter 3). Nonetheless, the survey data was useful in reaching some limited indicative observations on State and Territory differences. In summary, these are:

- Average unit costs of access vary little from State to State, but are lowest in Queensland (about 25 per cent lower than in other States).
- Local call costs vary little from State to State.
- Average mobile call rates reported by respondents are lowest in Victoria (42 cents per minute) and highest in Queensland and the Northern Territory (slightly more than \$1 per minute).

Small cell problems were much less of concern in the analysis of regional variations in the unit price of services. The survey results on such differences are presented in Table 12. The table confirms that prices for services increase with increasing distance from major metropolitan areas. The low monthly ISP access charge for 'Other Areas' is primarily due to the predominance of dial-up modem ISP access in those areas (48.8 per cent of Internet connections — almost twice the proportion reported in metropolitan and larger regional areas). The corresponding proportions for Metropolitan Areas and Larger Regional Areas are 29.8 per cent and 25 per cent respectively. An additional 19.4 per cent of Internet connections in 'Other Areas' is via a permanent modem. The cost of ISP access per month reported by almost 90 per cent of those with a dial-up modem was less than \$200. The monthly cost reported by 50 per cent of those with a permanent modem was also less than \$200.

Table 12: Average Unit Cost of Telecommunications Services by Region

	Tel/Fax Line ^a	Local Calls	Mobile Calls Daytime	Data/Private Line ^b	ISP Access	ISP Access ^c
	(\$)	(cents)	(cents/min)	(\$)	(\$/hour)	(\$/month)
Metro Areas	29.4	18.1	53.0	592	2.30	745
Large Regional Areas	31.3	20.4	75.4	690	--	939
Other Areas	31.6	20.8	82.2	735	--	164

Notes: a: Includes service and equipment.
 b: Does not take account of line capacity.
 c: Limited number of responses.
 d: Does not take account of connection capacity.

8. Prospects for Voice over IP in the Education and Training Sectors

Introduction

(Note: Further information about this topic - particularly the technical and changeover cost considerations may be found at Appendix 3).

The term Voice over Data refers to the generic transmission or carriage of voice calls in digital format over a data network. Voice over IP (VoIP) is a specific form of voice communication over data networks using the Transmission Control Protocol/Internet Protocol (TCP/IP). Another specific form is Voice over Frame Relay that is commonly used in networked offices (for example, Bunnings Building Supplies P/L).

VoIP represents a significant step toward the integration of voice and data networks. The possibility of voice communications travelling over the Internet or other data networks, began to emerge in the middle 1990s. It was then that software to compress voice signals and translate them into IP packets for transmission over the Internet was first developed. The early developments enabled calls to be made only between parties using computers with appropriate software. Subsequent technology advances have facilitated the development of interfaces between the Internet and traditional telephone networks enabling users to communicate via standard telephones. The primary attraction of VoIP is its capacity to provide long distance calls without incurring the long distance call charges associated with the traditional use of telephone networks.

VoIP can be applied to almost any voice communication, ranging from a simple interoffice intercom to complex multi-point teleconferencing. It can also be used for multimedia applications. There are three broad categories of VoIP services:

- Corporate-based VoIP supplied over local area networks (LANs) and over wide area networks (WANs);
- Public Carriers and Carriage Service Providers' VoIP including IP Telephone Service Providers (ITSP) and Converged Service Providers that deliver bundled voice, data and video;
- PC to PC VoIP which is normally a consumer product over the public Internet.

Current use

Integration of voice and data is limited even among large corporations and the Government sector. When deployed it is typically used only for intra-organisation traffic for niche applications, such as companies connecting mine sites or inter-capital branch offices. Most other calls are usually made via traditional telephony.

Although interest in voice and data integration continues to be strong, implementation trends on corporate communications networks have been slow. This is likely to be due to such considerations as:

- The economics of purchasing the required new technology equipment (particularly in the light of tariff reductions in voice call costs, especially for STD and international calls).
- Security and redundancy considerations associated with having all communications for a site pass through a single end point network connection.
- Noting that the fastest growing traffic is fixed to mobile/mobile to fixed, there are growing limits to the extent to which traditional voice networks can be by-passed.

Public carriers and carriage service providers

Several carriers are offering or using voice over IP services. The following is summary of current usage:

One.Tel

One.Tel is a fixed line and mobile telephone service carrier and ISP that operates in Australia and Western Europe. It makes extensive use of VoIP technology for its long distance routes.

OzEmail

OzEmail launched a public access VoIP service in 1997 restricted to users of its ISP services. Users made calls to a local number, which terminated, via the PSTN, on a gateway at an OzEmail point of presence (POP). After the user entered a PIN and the destination number to the gateway, the call was routed using IP to the POP closest to the destination number where it was connected to the local PSTN for delivery to the called telephone service. A service for corporate users relied on IP over ATM to obtain better quality of service (QoS). The service was discontinued following considerable falls in carrier tariffs for both national and international calls.

Datafast Telecommunications Limited

Datafast Telecommunications Limited is a publicly listed company. Based at Geelong, Victoria, the company started as an Internet service provider servicing business and residential customers throughout most of south western Victoria. With the acquisition of the VivaNet business in March 2001, services have now been extended to cover most of Australia. In 2001, Datafast also acquired the business of NorthVoice Communications Pty Limited, an established telephone service provider, specialising in National and International long distance services. It currently offers a VoIP service 'Flatworld' to both domestic and business customers. POPs for the service are located in Sydney, Melbourne, Brisbane, Geelong, Ballarat, Colac, Camperdown, Warrnambool, Portland, Morwell, Hamilton and Mt Gambier (SA). During 2001 Datafast intends to roll the network out to cover most of Australia.

ihug

ihug is an ISP that provides VoIP telephony to the public using either preselection or a national access code of 1477. The service was launched in October 1999 but it makes no guarantees on QoS.

ITSP Australia

ITSP is a recent start-up company aiming to provide a service linking Australia's six major cities reaching over 85 per cent of Australia's population. Work on the Australian network is underway with an expected completion date in the second quarter of 2001. Orbit Canada is providing the VoIP software and ITSP will be offering this service only to Internet Service Providers (ISPs) on a monthly wholesale basis for onselling to customers.

COMindico

COMindico is a wholesale only communications service provider with a national IP convergent network. Its network features include carrier grade voice capability in a pure IP network. COMindico has 66 POPs nationwide.

Current use on corporate wide area networks

Corporate use of VoIP includes both carrier-provided solutions and customised services.

Carrier provided solutions generally involve the replacement of on-net PABX to PABX calls rather than PSTN calls. In such solutions, a router is connected both to the PABX and to the customer's LAN. Telstra's Private IP Solutions (TPIPS), for example, is a corporate strength Intranet network. TPIPS can provide an organisation (such as a Statewide TAFE system) with an IP virtual private network (IP VPN) delivered on a secure infrastructure, not as an Internet based VPN. TPIPS provides any-to-any IP connectivity between customer access and the VPN. (Wesfarmers Rural Division, with some 250 sites provides an example of such an application).

Customers have a choice of three different classes of service:

- *Multimedia.* For voice or other traffic requiring minimum latency, minimum delay variation and a high data delivery ratio.
- *Interactive.* For data traffic requiring low latency, low delay variation and good data delivery ratio
- *Data Transfer.* For data traffic with more relaxed latency/variation and data delivery ratio objectives (e.g. E-mail, Messaging).

For the education sector, a multimedia class of service VPN would be recommended to support the deployment of IP telephony and H.323 videoconferencing applications.

Managed IP services are provided by several carriers and service providers other than Telstra.

The following are brief descriptions of some customised services.

CSIRO

CSIRO has implemented VoIP using Cisco routers over an ATM backbone of 34Mbit/s and 155Mbit/s links. It has achieved full voice call feature transparency over IP. The VoIP network is used for all interstate calls via an IP gateway located in each capital city. Regional site to state hub calls also traverse the IP network. The network has been

operational since October 1999 with call charges estimated to be 70-90% lower than carrier charges.

VicOne

VicOne is a private IP network provided to the Victorian Government by AAPT. It claims to be the largest private IP network in Australia with 3,500 sites, the largest group of which are from the education and training sectors. The network is IP at the edge with a core of Frame Relay and ATM. To date, VicOne has not been used to carry voice traffic.

Education Department of WA

Sevenoaks College, a new government school in Perth, is using the Cisco AVVID infrastructure and IP telephones. The school has an optic fibre cable link to One.Tel for its Internet access and all inbound/outbound voice call services. It also has a permanent connection to the Education Department of WA main server for E-mail.

The Education Department of WA called for tenders in early 2001 for voice, data and video transmission services. The responses included one carrier offering the possibility of a Statewide IP data network with a monthly charge per telephone handset inclusive of all voice calls (not only on net but also off net).

AARNET

AARNET provides high capacity Internet services between eight State and Territory based regional networks consisting of 37 Australian universities, CSIRO, DSTO and ANSTO. AARNET's VoIP implementation uses H.323 based IP between existing PABXs. It does not accept incoming voice calls over the IP infrastructure but AARNET users who have a VoIP connected PABX can make calls across AARNET and 'hop-off' into the PSTN in a remote local call zone, thereby saving on long distance costs.

Prices of public VoIP services

The following are sample tariffs for public VoIP services (as at May 2001).

Datafast Telecommunications Limited (product name Flatworld)

Flatworld offers two tariffs:

- National Capital Long Distance tariff of 25 cents for the first 5 minutes, and 4.9 cents per minute thereafter, to a maximum of 99 cents per call.
- National Regional Long Distance of 16.5 cents per minute anywhere else in Australia.

One.Tel (Administrator Appointed)

One.Tel has been offering several distance-based tariffs that are summarised in Table 13.

Table 13: One.Tel VoIP Tariffs

Distance Category	Rate/minute
Intercapital etc *	21c
Other long distance calls:	
25-50km	13c
51-85km	20c
86-745km	28c
745km+	30c

*For calls between Adelaide, Brisbane, Canberra, Darwin, Gold Coast, Hobart, Melbourne, Newcastle, Perth and Wollongong.

ihug

ihug offers two tariffs:

- National calls at 22c/minute; and
- Fixed to mobile calls: 35c/minute

Comment

The tariffs for VoIP currently on offer from carriers and service providers do not appear to be particularly attractive compared to typical large user PSTN/ISDN rates (see Table 14). The Consultants consider most statewide educational/training organisations should be able to negotiate similar rates with any of the leading national carriers.

Table 14: Indicative PSTN Tariffs for Large Statewide User

Charge Category	Flat Fee	Rate
Local Calls	nil	12c (untimed)
Long Distance Calls	nil	11c/minute
Fixed to Mobile Calls	14c (flagfall)	28c/minute
Access Charges for a PSTN Exchange Line	\$190 (installation)	\$330 annual

Prospective developments and trends for VoIP

Despite the fact that most companies believe that the future of voice is in IP, the take-up of this technology has been somewhat slower than was first anticipated. One reason is concern about voice quality sent via packets and another is that there is a vast amount of legacy PABX equipment in use, and the migration to IP telephony will always have to be justified in terms of replacing 'fit-for-purpose' PABX equipment with newer technology. Other barriers to take up are listed in Appendix 3.

Longer-established carriers such as Telstra, Optus and AAPT believe that the VoIP technology will become more prevalent, and are well advanced in rolling out their new network technologies to enable users to benefit from this. Nevertheless, the economics of migrating to VoIP, and on to full IP Telephony, are often finely balanced, and at this point in time there is usually justification in using both PSTN/ISDN voice lines in parallel

with a sophisticated data network. That said, some new carriers such as One.Tel have been using VoIP for long-distance telephone calls for several years now.

Benefits of IP VPN to the education and training sector

The benefits of adopting Private IP VPN solutions in the Education/Training sector include:

- *Any to any connectivity:* Any access to the VPN has IP connectivity to all other sites that are part of the VPN. This supports directly the any-to-any connectivity required for IP telephony or videoconferencing between Education/Training sites. It also directly supports the future ASP (Application Service Provider) model where there may be many ASP/ISP locations, both metropolitan and regionally based. Traffic is carried within the Private IP network, and is not required to 'trombone' via a Central Office.
- *Geographic coverage:* the service can be available to all metropolitan sites and most regional sites.
- *Modularity:* Such solutions support a variety of access services - from PSTN services to Gigabit Ethernet.
- *High level availability:* IP solutions are engineered to be robust and to offer a high level of service availability and reliability. Single points of failure typically associated with 'hubbed/aggregated' networks are removed. For example, the core network target availability for Telstra TPIPS is 99.85% - similar to frame relay.
- *Simplicity:* The dimensioning of backbone links and the management of complex network devices is done by the carrier. Each Education/Training site has a single connection to the VPN. The main network design issue is reduced to 'how much bandwidth to this site is required?' Routing devices at the campus/school require a single WAN interface for voice/data/text/video.
- *High performance:* The service can have specified service levels associated with data delivery, latency and jitter. This supports the deployment of videoconferencing and telephony applications as well as providing high performance for IT applications. There is also improved latency over alternatives, such as 'hubbed' frame relay, which add additional hops and satellite connections.

Feasibility of VoIP

Worldwide, the volume of data traffic is increasingly exceeding the volume of voice traffic. To cope with this situation carriers worldwide are shifting from voice switched networks with data overlays to packet switched networks that can carry voice. Telstra has publicly committed to an all-IP structure by 2005. Various standards bodies are collaborating on standardising a total end-to-end VoIP architecture.

The establishment of a VoIP network architecture can involve considerable investment in new equipment. For example, voice traffic normally originates through a PABX or a key system, and requires integration with a Voice/Data gateway. Some PABXs and many key systems, however, do not have this capability and would need to be upgraded or replaced. A newer but not well-established trend yet is for LAN-based telephone systems that use 'IP phones' and a voice-compatible router. If the VoIP service is to be converged

with an already existing corporate data network that has voice-compatible routers then only an upgrade in speed of the leased line will be required.

For further details refer to Appendix 3.

Conclusions on VoIP

The VoIP long distance voice call tariffs quoted above do not appear to be particularly attractive compared when compared with PSTN tariffs achievable by large statewide users (also indicated above).

As most Government education training systems in Australia have established or are establishing IP-based WANs, it can be expected in due course that the individual sites will utilise a connection from their PABX or key telephone system to the WAN. The WAN will then be able to carry on-net voice call for free (this is called toll by-pass). An interconnection fee will normally apply for off-net calls to connect across to the PSTN. In such situations, there can be a significant saving in telephone exchange lines (e.g., for a multi-campus TAFE) by using a single access path to/from the PSTN instead of each campus having its own dedicated (less traffic efficient) exchange lines (costing typically \$330 per annum each line). This could be of particular significance to smaller educational institutions in regional and rural areas.

While toll by-pass can result in savings for some organisations, the real savings in IP telephony accrue from decreased capital and support costs over the long term. These include:

- reduced capital infrastructure to support a single network;
- consolidation of support skills and personnel required;
- simplification of and reduced cost of moves/adds/changes; and
- easier integration of support for home office/teleworkers.

Consideration should also be given to new generation VoIP-based computer telephony integration (CTI) applications that can improve productivity.

The paramount consideration in contemplating the transition from circuit switched telephony to VoIP is the amount of inter-site voice/fax traffic that could be sent over the organisation's WAN thus avoiding long-distance call charges (Mitel Corporation, 2000a).

Nevertheless, 'toll by-pass' can be an elusive target since long distance prices have been falling consistently - especially for large organisations with 'buying clout'. As illustrated above, VoIP prices for long distance calls supplied by public carriers are not necessarily lower than conventional circuit switched call prices (as at May 2001). VoIP is unlikely to materially reduce the cost of local calls, access charges (exchange lines), fixed-to-mobile calls, or mobile calls. Accordingly, only the long distance voice calls component of the monthly telephone bill would be materially affected, and the extent of difference that would make would depend on the nature of the call dispersion and call holding times.

Another issue is that a single wide area network capable of delivering Quality of Service (QoS) good enough to converge voice and data may be more expensive to implement and run. Having said that, in 'greenfield' sites involving new building construction, a single network infrastructure may be less expensive to implement than separate

infrastructures. Any PC can be a telephone point through a piggyback jack. (On the other hand, stand-alone Ethernet IP telephone handsets tend to be much more expensive to purchase (as at May 2001) than standard PABX-style handsets).

The consultants recommend that education/training organisations should be wary at present of putting too much weight behind existing cost savings arguments for Voice over IP convergence (Mitel Corporation, 2000b). There are, however, other benefits in that an in-house IP-based infrastructure enables applications that could not otherwise be implemented with a traditional PABX or key station system.

For example, taken in conjunction with a wireless LAN, great flexibility can prevail for both telephone and computer laboratory facilities for education/training institutions. Or consider a TAFE college with multiple campuses - in the past, a small PABX or key system would have to be installed at each site. In contrast, with an IP branch exchange (IPBX), a call server located at a central campus building can provide call functionality (including voice mail) for all remote campuses over the IP WAN.

9. Conclusions and Recommendations

Conclusions

The terms of reference for this study were broadly confined to the gathering and presentation of information relating to current and potential telecommunications service providers, related pricing structures and VoIP possibilities. Although the terms of reference did not call for specific recommendations on future action, the consultants considered it would be helpful to draw attention to conclusions reached during the course of the study and to propose a short list of possible 'action items' for consideration by EVAG.

The education and training sector is a major user of, and has an increasing demand for, telecommunications services. This demand is driven primarily by the integration of telecommunications and multimedia services in teaching and in the delivery of education services. Applications with increasing bandwidth requirements are rapidly being introduced as part of the education curriculum.

Distance education programs are playing an increasing role in the wider delivery of quality education and the adoption of online technologies in educational and training institutions is growing rapidly. All schools and TAFEs are connected to the Internet and so are most private VET providers and ACE organisations. Online technologies are particularly important for the delivery of training in the workplace and distance learning. Their use in schools and TAFEs can broaden immensely the capacity of educational institutions and students in rural and remote locations to access online resources and educational programs. The cost of access, however, is a constraint to more extensive and higher bandwidth Internet connectivity for education and training institutions, particularly those in non-metropolitan areas.

The delivery of telecommunications services to public education and training providers in the States and Territories does not follow any single clearly defined model. In some jurisdictions common arrangements apply to both the VET and education sectors while in others different arrangements cater for the specific requirements in each sector. In part, the arrangements reflect differences in the size of the aggregate demand from the sectors as well as historical, political and other legacy factors. The trade offs between the benefits of highly aggregated demand and the benefits of specialisation and flexibility require consideration of both economies and diseconomies of scale. It seems likely that there are some thresholds relating to the size of total demand that could suggest the most appropriate approach to follow. The different practices currently in use, therefore, offer an opportunity to evaluate a variety of approaches for consideration in decisions on future arrangements that may be more attuned to specific needs and requirements.

Competition, where present, has been the principal factor in reducing costs and increasing the affordability of telecommunications services. In metropolitan areas, where competition is strongest, the prices of some services have declined considerably since the introduction of competition. In regional and rural areas, where little competition has so far emerged, prices have been slow to decline. Furthermore, there has been little improvement in the quality of the telecommunications infrastructure and in its (consequential) capacity to support increasing demand for services such as high speed access to the Internet.

This study has found that overall there are relatively few areas in which alternative carriers are not available to supply services to education and training providers. Telstra, however, remains the primary carrier for some 80 per cent of providers. In regional and rural areas, even in cases where competitive suppliers of services exist, competition is not strong and is unlikely to strengthen significantly in the short-term. Alternative investment in competitive infrastructure has been low relative to metropolitan areas and competitive suppliers are dependent on Telstra's infrastructure to deliver services. This is likely to act as a substantial constraint on downward price movements and consequently, on the capacity of education and training providers to contain their expenditure on telecommunications services.

Schools and TAFEs have been beneficiaries of initiatives by most State and Territory Governments to use their buying power to secure better services and competitive prices for government agencies. These initiatives have been able to achieve considerable savings on telecommunications expenditure as well as improvements in the quality of services supplied. In some cases, however, 'lock-in' effects have been reported suggesting that contracted prices may not have kept pace with downward movements in market prices. This means that, although better deals may become available from alternative carriers, users cannot take advantage of them because of exclusive supply arrangements involved in some Government initiatives. The dynamic character of the telecommunications industry places a premium on the retention of some flexibility in longer-term purchasing arrangements. Such flexibility should not be compromised without very careful consideration.

In all States and Territories the needs of public education and training providers are probably the largest generators of demand for telecommunications services within broader Government purchasing arrangements. This can give education and training authorities a position of some strength in the negotiation of supply arrangements. Depending on the overall scale of education demand alone it may be possible to secure more favourable deals specially tailored to meet the specific needs of education and training providers. This position of strength may be further enhanced if demand of public providers can be aggregated with that of non-government education institutions. Some of the benefits of such aggregation have already been achieved in a number of jurisdictions.

Private VET providers and ACE organisations are typically stand-alone units and lack the interconnected statewide formal structure that is a feature of school systems and TAFEs. They also lack the size and related buying power of higher educational institutions. In practice they are in position similar to that of most small and medium enterprises. This means that they have little influence on the quality and prices of services available to them. The study found that, other than for services subject to regulated prices, ACE and private VET providers invariably paid higher prices for their services.

Private VET and ACE providers on their own do not have sufficient buying power to secure favourable terms and conditions of service. To a large extent, this is due to their dispersed location and lack of a centralised administration capable of coordinating their requirements and negotiating collective supply arrangements on their behalf. There may be some scope, therefore, to integrate the needs of private VET providers and ACE organisations into the arrangements negotiated for schools and TAFEs. Such integration could improve both the quality and prices of telecommunications services they consume. Initiatives of this type do not appear to be common and are likely to require a 'champion' to promote them. In Victoria, for example, the Adult Community and Further Education Board has received a Commonwealth grant to develop network connections to link

country Victorian ACE organisations to the State's VicOne network. Evaluation of the success of that initiative and its potential for use as a model in other States and for private VET providers may be desirable.

The study found little variation in the competitive and pricing structures for telecommunications services from State to State. The differences that existed were mainly due to population distribution patterns. Certainly, there are considerable differences between metropolitan, regional and rural areas within each State. The greater the non-metropolitan proportion of a State the more likely that the degree of competition is lower and that prices for services are higher. The quality of the available services is also likely to be lower in the non-metropolitan areas of those states.

The main attraction for Voice/Data integration by the Education and Training sector is the potential for cost reductions on intra-organisational telephone call costs. Established data networks, for example, could carry so-called 'off-net' calls, say, from a country school or TAFE could transit via the Central Office PABX and thus access the PSTN to communicate with someone in the metropolitan area for the cost of a local call.

The benefits of such 'toll by-pass' may be elusive to a degree because long distance call prices have been falling consistently, especially for large organisations with considerable buying power. VoIP prices for long distance calls from public carriers are not necessarily lower than conventional circuit switched call prices (as at May 2001). In addition, VoIP is unlikely to materially affect the cost of local calls, access charges (exchange lines), fixed-to-mobile calls, or mobile calls. Accordingly, only the long distance voice calls component of the monthly telephone bill would be materially affected, and the extent of difference that would make depends on the nature of the call dispersion and call holding times.

The establishment of a single wide area network capable of delivering sufficient 'quality of service' for carriage of both voice and data can be expensive to implement and run. The requirements for additional bandwidth, more sophisticated switches and IP routers with traffic shaping, prioritisation and bandwidth reservation may add so much to costs as to outweigh the savings from lower long distance call costs. In a 'greenfield' situation, however, where a totally new network is being set up, a single network infrastructure may be less expensive to implement than separate infrastructures.

Plans for the introduction of VoIP facilities will need to consider carefully a range of quite complex benefits and possibly uncertain costs to determine whether the investment is likely to generate a net benefit.

Given current costs structures, the rapid rate of developments in this area and the projections from the major carriers, the consultants are inclined to conclude that there are unlikely to be worthwhile benefits accruing to the education and training sector from being 'early adopters' of VoIP technology.

Recommendations

A further study should be conducted to extend the findings of this research and quantify current and future telecommunications services demand (including Internet) stemming from education and training providers. By quantifying the magnitude of the demand for telecommunications services, education and training authorities would enhance their capacity to influence the development of procurement policies and secure more favourable arrangements for the supply of services to education and training providers.

The different practices for the provision of telecommunications services currently in use in the States and Territories should be compared and evaluated with a view to developing models likely to maximise benefits in the prevailing circumstances in each jurisdiction.

Successful arrangements involving the coordination and aggregation of telecommunications demand from both government and non-government education providers should be examined with a view to implementing them in other jurisdictions where there is commonality in educational goals and requirements.

Initiatives to aggregate telecommunications demand for ACE and private VET providers, such as that being undertaken by the Adult Community and Further Education Board in Victoria should be evaluated to assess their benefits and applicability in other jurisdictions.

Education and training organisations should be cautious about the magnitude of likely cost savings attainable from the introduction of Voice over IP. Introduction of an in-house IP-based infrastructure, however, may generate benefits such as enabling applications that could not otherwise be implemented with a traditional PABX or key station system. Consideration of such additional benefits may make Voice over IP attractive, particularly in the planning and provisioning of new infrastructure investment.

Action items

The recommendations arising from this study lead to a number of briefly-stated initiatives that merit some consideration for future action by EVAG:

1. Commission a study to extend the findings of this research and quantify current and foreseeable levels of demand for telecommunications services (including Internet) for the entire education and training sector. (Such information would enhance the capacity of education and training authorities to influence the development of procurement policies and secure more favourable arrangements for the supply of services).
2. Evaluate the different practices for the provision of telecommunications services currently in use in the States and Territories with a view to developing best practice approaches most suited to the prevailing circumstances in each jurisdiction.
3. Examine successful arrangements involving the coordination and aggregation of telecommunications demand from both government and non-government education providers for possible implementation in other jurisdictions.
4. Explore the potential for extending or emulating successful arrangements implemented in the secondary schools sector to the VET sector.
5. Evaluate the potential of demand aggregation initiatives to achieve cost savings and better quality telecommunications services for ACE and private VET providers.

10. References

Australian Competition and Consumer Commission (ACCC) (2000), Submission to Productivity Commission Inquiry into 'Telecommunications Competition Regulation', available at <http://www.pc.gov.au/inquiry/telecommunications/subs/sub040.pdf> (accessed 24 April, 2001).

Australian ISP List (2001) <http://www.cynosure.com.au/isp/@statistics> (accessed 24 April).

Jennings, B. (2000), 'Price Competition in Australian Fixed Line Telecommunications: Three Years After Deregulation', Paper Presented at Communications Research Forum 2000, available at <http://www.dcita.gov.au/crf/papers2000/jennings.pdf>.

Mitel Corporation (2000a) 'IP Telephony — The TCO Value Proposition', White Paper, available at http://www.mitel.com/products/ipera_2000/ipera_2000_whitepaper2.pdf.

Mitel Corporation (2000b), 'Mitel Data Integrated Choice Application Architecture', White Paper, available at http://www.mitel.com/products/ipera_2000/ipera_2000_whitepaper1.pdf.

National Bandwidth Inquiry (1999), *2000-2004 Bandwidth*, Report of the Australian Information Economy Advisory Council, Department of Communications, Information Technology and the Arts, Canberra.

Productivity Commission (2000), *Population Distribution and Telecommunications Costs*, Staff Research Paper, AusInfo, Canberra.

Productivity Commission (2001), *Telecommunications Competition Regulation*, Draft Report, Canberra.

Telecommunications services Inquiry (2000), *Connecting Australia*, Report, Department of Communications, Information Technology and the Arts, Canberra.

White, G. (1999), 'Online Education Report', available at <http://www.edna.edu.au/edna/publish/system/edures/edreport.html>.

Appendices

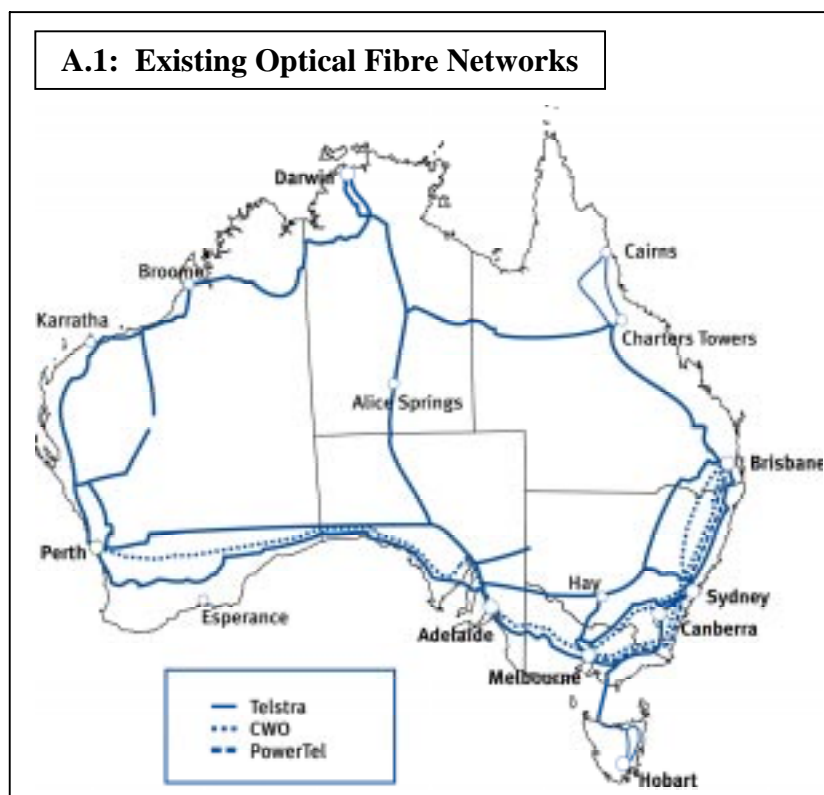
Appendix 1: Current and Proposed Major Networks

Appendix 2: Survey Methodology Documents

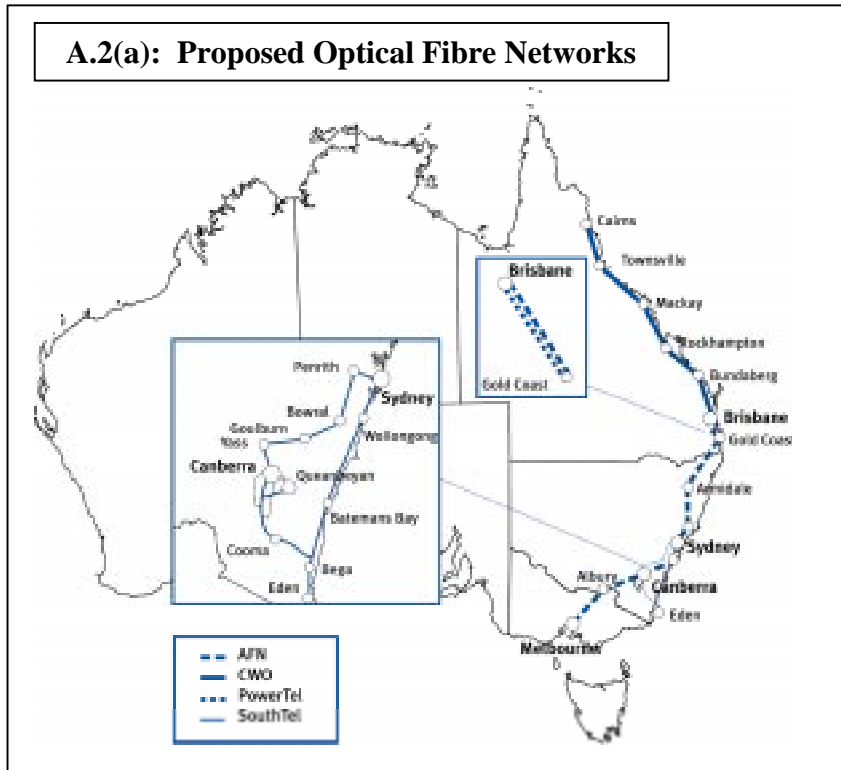
Appendix 3: Voice Over IP (Technical Aspects)

Appendix 1: Current and Proposed Major Networks

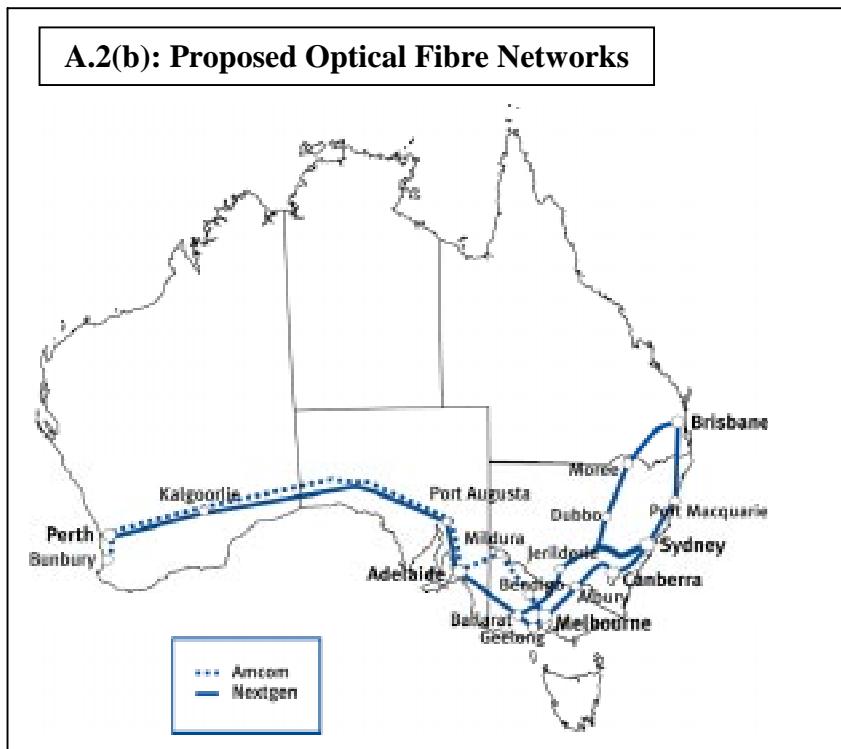
The following maps showing existing and proposed major optical fibre and microwave networks have been reproduced from the report of the Telecommunications Services Inquiry (2000).



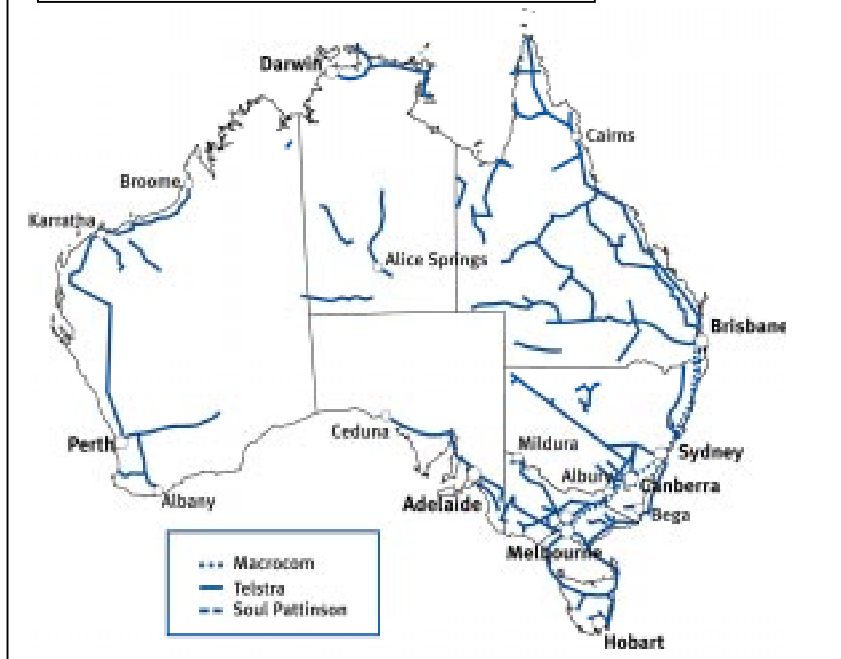
A.2(a): Proposed Optical Fibre Networks



A.2(b): Proposed Optical Fibre Networks



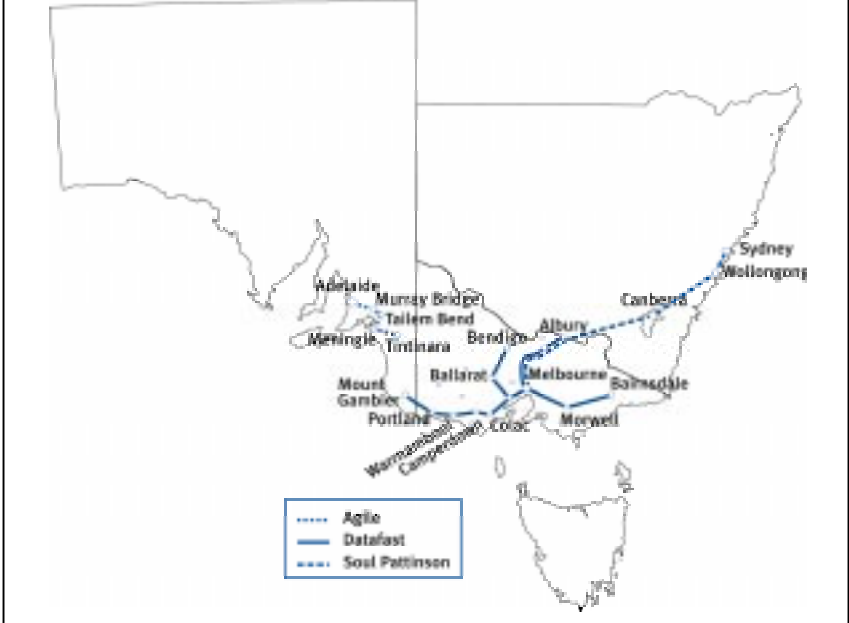
A.3: Existing Microwave Networks



A.4(a): Proposed Microwave Networks



A.4(b): Proposed Microwave Networks



Appendix 2: Survey Methodology and Documents

Identification and selection of survey sample

Primary objective

To collect telecommunications cost information focusing on VET/ACE organisations and comparative information from schools and higher education institutions.

The sample

The sample ensures an adequate metropolitan and non-metropolitan representation in each State/Territory consistent with the objectives of the study.

In non-metropolitan areas, the sample ensures an adequate representation of both large and smaller regional areas.

The distribution also takes account of the different institutional arrangements for the VET/ACE sectors in the States and Territories

To further emphasise the VET/ACE focus, most of the schools selected in the sample are registered VET training providers. In achieving greater emphasis for VET/ACE providers within the agreed sample size, safeguarding of the quality of comparative analysis with schools limited the extent to which representation of schools could be reduced. Indeed, a small increase in the sample size was made to ensure the relativity between the two sectors is maintained.

Sources of information

The National Training Information Service (NTIS) maintains a detailed list of State Training Authorities (STAs) and the Registered Training Organisations (RTOs) registered by them. This information, augmented where necessary from other sources, was the primary source for the sample selection.

For each RTO, NTIS provides:

- Contact details; and
- Listing of the training services offered.

The training services are classified in terms of:

- Recognition for national qualification
- Units of Competency; and
- Courses offered.

Selection Process

The NTIS lists all RTOs registered by each STA. These include not only schools, training centres and the like, but also training services provided by industrial organisations, training consultants and others.

On the basis that the primary interest for this project is information on telecommunications costs for VET and ACE organisations, a number of filtering processes were necessary to identify relevant and appropriate organisations:

- In the initial filtering, all listings clearly relating to training services offered within an organisation (e.g., as part of an apprenticeship scheme) or within institutions not primarily established for training (e.g., correctional services institutions) were removed from the listing.
- A second filtering involved the identification and removal of RTOs whose NTIS listing indicated that they did not offer any courses.
- Finally, only organisations that were listed as offering services recognised for a national qualification and offering courses in one or more units of study were retained in the 'population of organisations' for use in the selection of the final sample. This final filter removed, for example, consultants hiring themselves as trainers in courses leading to a national qualification.

It was not possible to undertake similarly detailed filtering processes for information from other directories. However, considerable care was taken to ensure maximum compliance with the selection criteria.

The filtering process produced a population that included private and public schools, TAFEs, tertiary institutions, private training providers and adult and community education organisations. The population was subdivided by State/Territory and metropolitan, regional and rural location within the States and Territories.

The sample was then selected randomly from each of the geographical subsets of the population

The survey instrument

Education Network Australia Vocational Education and Training Advisory Group

AUSTRALIAN FLEXIBLE LEARNING FRAMEWORK

Feb-01

TELECOMMUNICATIONS AND INTERNET PRICING STRUCTURES SURVEY

All information provided will be kept confidential. Analysis will not identify individual returns

Please reply by email, if possible to: telcostsurvey@comedu.canberra.edu.au

Send enquiries & replies to: Linda Zakman, Professional Communication, University of Canberra

Telephone: 02-6201 2475

E-mail: zak@comedu.canberra.edu.au

or fax: 02-6201 2630

or mail: Linda Zakman, Professional Communication, University of Canberra, ACT 2601

Due return date: ASAP

Institution Name:

Type of institution: Please choose one

- (1) School
- (2) TAFE
- (3) Private VET Provider
- (4) Adult and Community Education
- (5) Agricultural College
- (6) Language or Business College,
- (7) University and Higher Education
- (8) Other.....

Town or Suburb: Postcode:

Respondent: ABN

E-mail:

Tel. Fax

1) How would the location of your institution be classified?

Please choose one

- (1) Metro (including Outer metropolitan)
- (2) Large Regional Centre
- (3) Other Regional and Remote Areas

2) How many students are enrolled in your institution?

Please choose one

- (1) less than 300
- (2) 300 to 700
- (3) over 700

- 3) What telecommunications carrier does the institution principally use?
- Please choose one

(1) Telstra

(2) Optus

(3) AAPT

(4) Primus

(5) OneTel

(6) PowerTel

(0) Other (Please specify).....
- 4) What secondary telecommunications carrier does the institution use (if any)?
- Please choose one

(1) Telstra

(2) Optus

(3) AAPT

(4) Primus

(5) OneTel

(6) PowerTel

(0) Other (Please specify).....
- 5) Is the choice of carriers mandated by departmental/central office policy?
- Please choose one

(1) Yes

(2) No

(3) Not applicable

(4) Don't know
- 6) Are there other carriers supplying telecommunications services in your area?
- Please choose one

(1) Yes

(2) No

(3) Don't know
- 7) What Internet Service Provider (ISP) does the institution use?
- Please choose one

(1) None

(2) Telstra BigPond

(3) BigPond Advance

(4) OzEmail

(5) OptusNet

(6) Primus

(7) AOL

(8) iPrimus

(9) Connect.com

(10) WestNet

(11) Infinity Online

(12) Net-tech

(13) Eisa

(00) Other (Please specifv).....
- 8) Are there other ISP providers available in your area at local call (untimed) rate?
- Please choose one

(1) Yes

(2) No

(3) Don't know

9) What type of Internet connection does the institution use?

Please choose one	
(1) <input type="checkbox"/>	Dial-up modem
(2) <input type="checkbox"/>	Permanent modem
(3) <input type="checkbox"/>	On-site ISP
(4) <input type="checkbox"/>	ISDN /OnRamp
(5) <input type="checkbox"/>	Satellite
(6) <input type="checkbox"/>	ADSLor DSL
(7) <input type="checkbox"/>	Microwave or Spread Spectrum
(8) <input type="checkbox"/>	Frame Relay
(0) <input type="checkbox"/>	Other

Provide an estimate of the institution's expenditure (for all campuses) (*) in calendar year 2000 for:

*** Exclude capital equipment for telephone systems, cabling, hubs, etc**

10) Telephone & fax lines (service and equipment)	\$	<input type="text"/>
11) Local telephone calls	\$	<input type="text"/>
12) Long distance telephone calls	\$	<input type="text"/>
13) Mobile telephones (if applicable)	\$	<input type="text"/>
14) Data leased lines & private lines (if applicable)	\$	<input type="text"/>
15) Telephone system maintenance (if applicable)	\$	<input type="text"/>
16) Internet (ISP charges)	\$	<input type="text"/>
17) Other (maintenance charges, etc)	\$	<input type="text"/>
18) Calculated Total	\$	<input type="text" value="0"/>

Provide the unit cost for the following:

20) Telephone & fax lines ('Service and Equipment')	\$	<input type="text"/>	per line/month
21) Local telephone calls	\$	<input type="text"/>	per call
22) Mobile telephone calls (daytime rate week days)	\$	<input type="text"/>	per minute
23) Data leased lines & private lines (if applicable)	\$	<input type="text"/>	per line/month
24) Internet - ISP access charge	\$	<input type="text"/>	per hour
25) or	\$	<input type="text"/>	per month
26) Internet - ISP monthly download allowance (if applicable)		<input type="text"/>	megabytes
26) Internet - download charges for usage above the monthly allowance	cents	<input type="text"/>	per megabyte

Provide details of any additional discounts received on:

- 27) Local telephone calls of total
- 28) Long distance calls of total
- 29) Mobile calls of total
- 30) Other expenditure of total
- 31) Any additional comments or explanations
by respondent:

telcostsurvey@comedu.canberra.edu.au

Mail address is: Linda Zakman, Professional Communication, University of Canberra, ACT,
2601.

(Communication and Media Policy Institute Letterhead)

**Education Network Australia, Education and Training Group
Telecommunications and Internet Pricing Structures Survey**

Dear Sir/Madam

Your organisation was included in a sample of educational and training organisations receiving a survey questionnaire for the collection of information on telecommunications services costs. The survey is part of a study being conducted on behalf of the Education Network Australia, Education and Training Group (EVAG) to inform future policy and strategic directions in the implementation of the Australian Flexible Learning Framework (see attached letter of introduction for more detail).

Your participation in the survey is very important to the success of the study. As we have not yet received a response from your organisation, I would like to entreat you to please take the time to prepare a response and return it to us as soon as possible.

The information you provide is essential to the development of strategies and programs to improve telecommunications services and reduce costs for educational and training institutions. By participating in the survey, therefore, you will be assisting the development of important initiatives that promise to deliver substantial benefits to your and similar institutions.

Your completed questionnaire should be returned in the enclosed pre-paid return envelope. Should you prefer to lodge a return by email, please provide us with an email address and we will supply you with an electronic version of the questionnaire.

Please note that all the details you provide will be confidential to the study team and will not be revealed to anyone else.

I would be most grateful for your assistance to this very important study and thank you in advance for any information you provide. Should you have any queries relating to the survey, please do not hesitate to contact me. My contact details are:

Telephone: 02 6201 5083
Fax: 02 6201 2630
e-mail: franco.papandrea@canberra.edu.au

I look forward to receiving your completed questionnaire.

Franco Papandrea
Project Director

2 March 2001

Copy of Letter of Introduction for the National Survey

Letterhead of:

Department of Education, Employment and Training
Office of Post Compulsory Education, Training and Employment

TO WHOM IT MAY CONCERN

TELECOMMUNICATIONS AND INTERNET PRICING STRUCTURES SURVEY

I am writing to you as Chair of the Education Network Australia Vocational Education and Training Advisory Group (EVAG). As part of the implementation of the *Australian Flexible Learning Framework*, EVAG has recently commissioned an Australia-wide study of telecommunications and Internet pricing structures as they apply to the education sector (Higher Education, Vocational Education and Training, Adult Community Education, and Schools). The aim is to ascertain the current pricing structures for the delivery of telecommunications and Internet services and how they affect the education system. The results will be used to assist and inform the development of future policy and strategic directions.

The expected major output of this project is the preparation of a research paper which:

- identifies current service providers of telecommunications services to the education sector in each State and Territory, including comparison between metropolitan, regional and remote delivery;
- identifies other potential service providers of telecommunications services to the education sector, including comparison between metropolitan, regional and remote delivery;
- details the current pricing structures for the delivery of telecommunication services to the education sector, including comparison between metropolitan, regional and remote delivery;
- identifies the current costs of Voice-over IP delivery and the likely future trends, including costs of transferring to Voice-over IP technologies.

This project is funded by the Australian National Training Authority (ANTA) and overseen by EVAG, the national VET advisory group for flexible and online learning. The study team comprises experienced consultants from the Communication and Media Policy Institute of the **University of Canberra** and **Peter Farr Consultants Australasia Pty Ltd**.

The enclosed questionnaire requests details regarding your institution's telecommunications and Internet usage and expenditure. The purpose of this letter is to introduce the consultants, and, on behalf of the Steering Committee, respectfully request that your organisation's prompt cooperation be extended to them in carrying out this challenging study. **Information provided through the survey mechanism will be kept strictly confidential and will not allow your organisation to be identified.**

The Project Director for the study is Associate Professor Franco Papandrea, Director of the Communication and Media Policy Institute, University of Canberra, and he is being assisted on the survey by his colleagues Dr Natalie Stoeckl and Professor Warwick Blood. Peter Farr, Chairman of Peter Farr Consultants Australasia is providing technical advice to the study team. Franco and Peter may be contacted by telephone on 02 6201 5083 and 08 9321 3688 respectively.

If you have any queries, please contact Julie Ahern, Manager, EVAG Secretariat on 03 9412 4401.

Yours sincerely

MEREDITH SUSSEX

DIRECTOR

5 JAN 2001

Appendix 3: Voice over IP (Technical Aspects)

This Appendix deals with some technical aspects of Voice over IP (VoIP).

VoIP is a specific form of voice communication over data networks using the Transmission Control Protocol/Internet Protocol (TCP/IP).

Traditional telephony and data networks developed separately and until recently were used exclusively for the provision of different services. Telephony transmissions primarily took the form of analog signals that travelled in their original form between sender and receiver. Data signals, on the other hand, are typically broken down into 'packets' at the sender's end for transmission over the network and are reconstituted into the original signals at the receiving end. Packet-based data transmission has a number of advantages one of which is that transmission can successfully take place even though some individual links in the network might be unavailable. In the case of data transmissions it is usually not critical that individual packets might travel over different paths and sometimes be subject to (short) delays. Such delays in the transmission path for voice communications would cause considerable problems, however, and for this reason data networks did not carry voice signals.

Quality of service considerations

Consistent with their attributes, the different forms of communication — voice, fax, data, text, and video — have different vulnerabilities to Quality of Service (QoS) parameters. Voice communication, for example, requires a real time connection between connected parties and is particularly affected by lost packets and variable latency delay ('jitter') that can be common in data transmissions. Public TCP/IP networks are usually designed on a so called 'best effort' basis, which is a much lower standard than provided by carriers' circuit switched networks such as Telstra's PSTN and ISDN (see Table 2-1):

Table A3.1: Quality of Service Parameters for Switched Networks

Service Level Parameter	PSTN/ISDN Access
Network Availability:	
Dial Tone from Exchange	> 99.0%
Call Dropouts	typically measured at less than 0.05%
Network Performance:	
Call Set-up Time	0.44 sec
Call Success Rate (busy or ring tone)	99.87%

Telstra's PSTN voice network has a hierarchical structure - a local exchange (which connects customers to the Telstra network) is linked to higher order trunk exchanges (which switch traffic between exchanges). Wherever possible, a local telephone exchange is connected to at least two higher order exchanges and via diverse transmission links. This provides resiliency to network or transmission failures by

providing alternate paths for the carriage of signal. Calls are accepted only when lines are available to make a connection between calling parties. At times of peak loads, when networks are busy, additional calls are not possible until the necessary lines are released by other callers.

In contrast, data transmission networks continue to accept transmission irrespective of the volume of traffic already on the network. Much like a busy road, traffic slows down as volume increases. Additionally, parts of a message may be sent by different routes and cannot be re-assembled into the original message until all succeeding parts arrive. Because of these factors VoIP can be of very low quality, particularly over the public Internet. Even on private Intranets, voice traffic must be identified and given traffic priority to minimise delays and ensure that quality does not deteriorate excessively.

Setting up VoIP

Corporate use of VoIP includes both carrier-provided solutions and customised services. Carrier provided solutions generally involve the replacement of on-net PABX to PABX calls rather than PSTN calls. In such solutions, a router is connected both to the PABX and to the customer's LAN. Telstra's Private IP Solutions (TPIPS), for example, is a corporate strength Intranet network, with specified performance parameters. TPIPS can provide an organisation (such as a Statewide TAFE system) with an IP virtual private network (IP VPN) delivered on a secure infrastructure, not as an Internet based VPN. TPIPS provides any-to-any IP connectivity between customer access and the VPN. Customer access can take place through a variety of layer 2 services such as:

- PSTN (via modems), ISDN, ADSL, IPSec (Internet tunnels);
- Frame Relay and ATM (to 34 Mbps);
- Ethernet 10/100/1000 Mbps (via Wideband IP); and
- Cable Modem, GPRS, Satellite.

Customers have a choice of three different classes of service with TPIPS:

- *Multimedia*. For voice or other traffic requiring minimum latency, minimum delay variation and a high data delivery ratio.
- *Interactive*. For data traffic requiring low latency, low delay variation and good data delivery ratio
- *Data Transfer*. For data traffic with more relaxed latency/variation and data delivery ratio objectives (e.g. E-mail, Messaging).

Managed IP services are provided by several carriers and service providers other than Telstra including: AAPT, Optus, CITEC, Convergent, Eclipse, Macquarie Corporate, Panaseer, TPG, TransACT and Vivanet.

Trends and developments

Despite the fact that most companies believe that the future of voice is in IP, the take-up of this technology has been somewhat slower than was first anticipated. Reasons for this include:

- The technology originated in the USA, where the majority of telephone calls incur time charges. In Australia, Government regulations will ensure the untimed/flat fee local calls will remain.
- The fastest growing sector of calls in Australia is 'calls to/from mobiles', which means that these calls must enter the public network at some point, thus diluting the potential benefits of VoIP to replace long distance carrier calls.
- There is a vast amount of legacy PABX equipment in use, and the migration to IP telephony will always have to be justified in terms of replacing 'fit-for-purpose' PABX equipment with newer technology.
- VoIP can make an organisation greatly dependent on its data network. Many companies would not wish to overlook redundancy and security issues and would be chary of pursuing 'convergence for the sake of convergence'.
- The success of VoIP is heavily dependent on the quality of the network to which the equipment is connected
- The IP PABX equipment is only now becoming a credible alternative to the mature technology of the traditional PABX equipment.

Longer-established carriers such as Telstra, Optus and AAPT believe that the VoIP technology will become more prevalent, and are well advanced in rolling out their new network technologies to enable users to benefit from this. Nevertheless, the economics of migrating to VoIP, and on to full IP Telephony, are often finely balanced, and at this point in time there is usually justification in using both PSTN/ISDN voice lines in parallel with a sophisticated data network. That said, some new carriers such as One.Tel have been using VoIP for long-distance telephone calls for several years now.

Future costs and feasibility

The establishment of a VoIP network architecture can involve considerable investment in new equipment. Voice traffic normally originates through a PABX or a key system and requires integration with a Voice/Data gateway for carriage over a VoIP network. However, some PABXs and many key systems do not have this capability and would need to be upgraded or replaced. A recent, but not well-established trend, is for LAN-based telephone systems that use 'IP phones' and a voice-compatible router. An example is the Cisco AVVID system with Cal Manager Software. Cisco does not believe it makes sense to run separate wiring systems to the desktop for voice and data so their solution is to plug an IP telephone into the LAN. Alternatively, similarly equipped users can talk through their PCs over the Internet using (for example) Microsoft's Netmeeting software.

The cost of switching from a circuit-switched environment to VoIP depends on a number of factors. The size of the subscriber site will dictate the type of access to the VoIP network or network provider. For example, a very small site might access the network by PSTN dial-up or by a national access code (14xx). In the first

instance, a local PSTN call charge would apply to a call made to the VoIP network, but with 14xx access the 14xx cost would be absorbed by the VoIP provider.

Larger sites would normally access the VoIP network from a PABX directly with a leased ISDN line or from a router by leased digital or ISDN service. ATM would only be used for large volumes of traffic. These types of access will incur a fixed annual fee per subscriber site. As an example, a 128kbps metropolitan ISDN service from a router to the VoIP POP with capped usage charges would cost \$435 per month (ex GST). In addition, there would be the one-time cost to provision the router. If the VoIP service is to be converged with an already existing corporate data network that has voice-compatible routers then only an upgrade in speed of the leased line will be required.

Another issue is that a single wide area network capable of delivering a service of sufficient quality to converge voice and data may be more expensive to implement and run. For example, more bandwidth may be needed, or more sophisticated switches and IP routers with traffic shaping, prioritisation and bandwidth reservation may be required. Having said that, in 'greenfield' sites involving new building construction, a single network infrastructure may be less expensive to implement than separate infrastructures. Any PC can be a telephone point through a piggyback jack. (On the other hand, stand-alone Ethernet IP telephone handsets tend to be much more expensive to purchase (as at May 2001) than standard PABX-style handsets).

The following list (Mitel Corporation, 2000a) indicates the relative ranking (in decreasing order of dollar returns) for the key cost factors to be considered in contemplating the transition from circuit switched telephony to VoIP:

- (a) cost per user for technical/administrative support for the current voice network;
- (b) cost of labour used to support moves, adds and changes;
- (c) expected growth of the school/college/campus in terms of new employees who will use fixed telephones;
- (d) the amount of inter-site voice/fax traffic that could be sent over the organisation's WAN (thus avoiding long-distance charges).

Given that (a), (b) and (c) would usually be low for education organisations, item (d) takes on greater importance.