IN THE MATTER OF UNDERTAKINGS DATED 23 DECEMBER 2005 LODGED BY TELSTRA CORPORATION LIMITED WITH THE AUSTRALIAN COMPETITION AND CONSUMER COMMISSION IN RESPECT OF UNCONDITIONED LOCAL LOOP SERVICE
("the Access Undertakings")

STATEMENT OF [c-i-c]

On 4 August 2006, I, **[c-i-c]** of 242 Exhibition St, Melbourne in the State of Victoria, **[c-i-c],** state as follows:

1 **[removed]**

2 I make this statement from my own knowledge, except where stated otherwise.

3 In this statement the following abbreviations have the following meanings:

CAN - Customer Access Network;

CPE - Customer Premises Equipment;

IEN - Inter Exchange Network;

IGE - International Gateway Exchange;

IGS - Interconnect Gateway Switch;

IRIM - Remote Integrated Multiplexer;

CMUX -Customer Multiplexer

LAS - Local Access Switch;

LTE - Line Terminating Equipment;

LTH - Local Transmission Hub;

PSTN - Public Switched Telephone Network;

RAU - Remote Access Unit;

RSS - Remote Switching Stage;

RSU - Remote Switching Unit;

TNS - Transit Network Switch.

4 I am the **[c-i-c]** , in Fundamental Planning Access, Network & Technology Group in Telstra Operations at Telstra Corporation Limited ("**Telstra**"). I have held this position since **[c-i-c]** . In my current role, I am responsible for the Planning, Capacity Management, Modelling and rules used for provisioning Telstra's CAN and also for the technology and infrastructure deployed in the CAN. Annexure "A" is my curriculum prior to this role.

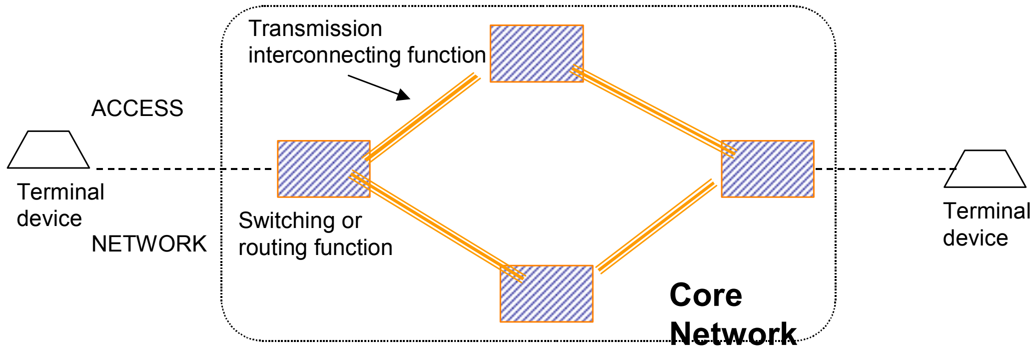
5 In this statement I refer to Telstra and its predecessors as "Telstra".

A. TELEPHONE NETWORKS

Overview of Public Switched Telephone Networks

6 A public switched telephone network consists of switches connected by transmission systems, somewhat similar to road intersections with traffic lights (switches) connected by lanes, minor roads, highways and freeways (transmission systems). The switches are generally specific to a set of services. The transmission systems are typically shared by all of the switches. The telephone traffic is somewhat similar to the vehicles using the roads.

7 All telecommunications networks have the same basic architecture, as illustrated below:



where:

terminal devices: (such as a telephone handset) provide user functionality and connection. These are sometimes also known as CPE (Customer Premises Equipment)

access networks: connect the terminal devices to the core (for example by way of copper cable or radio)

the core: carries the call from one access point to another

switching/routing: transfers/transits the call into/through the core making decisions about which route to take along the way

transmission: transports the call between switches.

Telephone Switches

8 Without telephone switches, we would need a dedicated telephone handset and line connecting to each person with whom we wanted to communicate.

9 Switches enable the transmission of telecommunications traffic by establishing a temporary connection between the calling party (usually referred to as the "**A-party**", who has the "**A-Number**"), and the called party (the "**B-party**", who has the "**B-number**"). Switches avoid the need for a dedicated telephone handset and line to each person with whom the A-party wishes to communicate.

10 Telephone switches differ in the manner in which their lines are used. Local switches have lines connected to customers and to other switches. Transit and international switches normally have lines connected only to other switches.

Transmission

11 Telecommunications transmission systems use electricity (electromagnetic radiation) or radio or light (optical radiation).

12 Sound is not useful for transmission over long distances because it is slow, it rapidly dissipates and it becomes mixed with other sounds. On the other hand, electricity and light are very fast, can be focussed and can be multiplexed (thousands of conversations can be carried on one system without getting them mixed up). So sound is converted to electricity (by a microphone) which is transmitted over the long distance, and then converted back into sound (by a speaker). The telephone handset at each end has a microphone and a speaker. The human voice once converted to electrical signals can be further converted into light signals and vice versa.

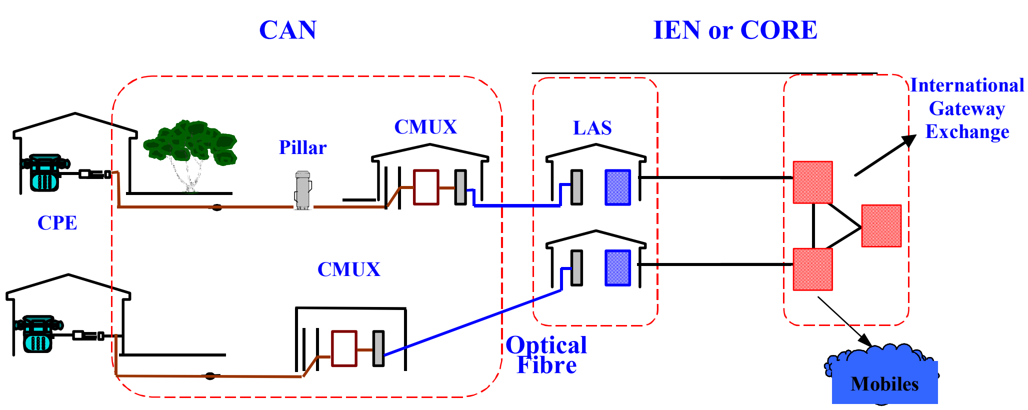
13 Data to and from computers is already in electrical form.

14 Pictures can readily be converted into electrical form by treating each picture as a series of horizontal lines, each line consisting of a series of dots, and then sending electrical signals to represent the dots and their characteristics.

Telstra's PSTN (Public Switched Telephone Network)

15 The PSTN is Telstra's largest telecommunications network, and has about 10 million fixed line services connected to it. The physical elements of Telstra's PSTN comprise the CAN (customer access network), LAS (local access switches) and the IEN (inter-exchange network).

The PSTN is illustrated as follows:

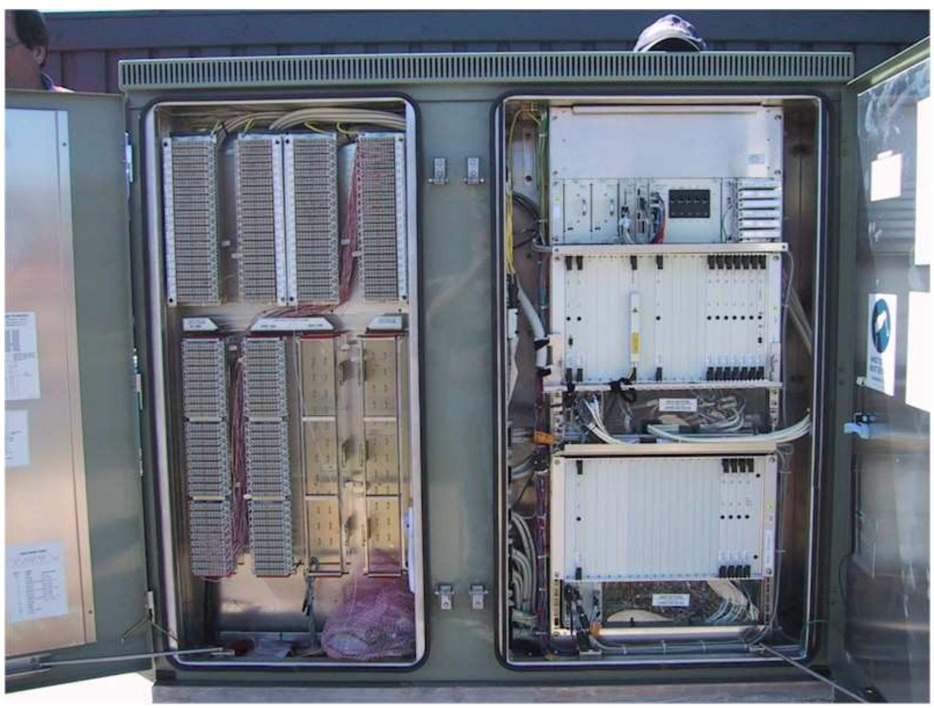


In the above diagram:

CPE	is customer premises equipment, which is any equipment used to connect to the network such as a telephone or facsimile machine.
Pillar	is a cross connection point connecting cables directly connected to customers with those directly connected to an exchange. I describe pillars further below.
CMUX	Customer Multiplexer, which enables a number of customers to be connected via an optical fibre transmission system to a LAS.
LAS	Local access switch, which is a switch in the IEN or the Core Network which is connected to customers (as opposed to only being connected to other switches). I describe LASs further below.

16 The CAN is that part of Telstra's PSTN which extends from customers' premises to the customer side of Telstra's RAUs (Remote Access Units). RAUs are subscriber stage concentrating units, generally within a few kilometres of a customer and are associated with a LAS (local access switch). An RAU can be a CMUX. Each LAS has many RAUs. The point at which Telstra's network terminates at customers' premises is known as the network boundary point.

17 A CMUX is a Customer Multiplexer. It can be located in the street in an aboveground housing. Below is a picture of the outside of a CMUX and a picture of the internal view of a CMUX:



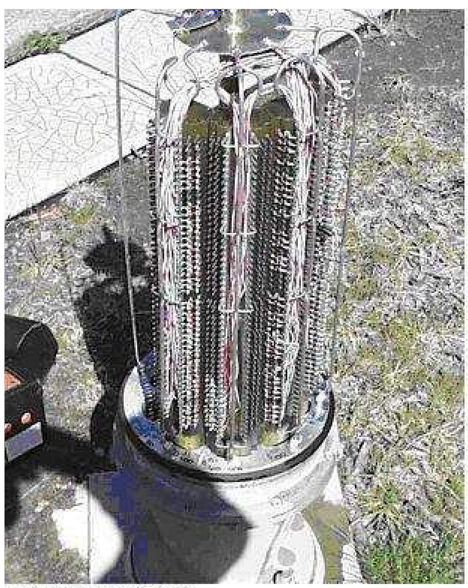
18 The CMUX only exists remotely from the LAS to which it is parented. Typically, multiple CMUX units are parented from a LAS. The CMUX units are modular on the customer side having the capability of connecting up to 420 customer lines each.

On the network side, CMUX have the capability of connecting to a number of 2 Mbit/s streams. 2 Mbit/s refers to 2,048,000 bits of information transmitted per second. Each 2 Mbit/s stream can accommodate calls from any of the customer lines and can handle up to 30 simultaneous calls. This is done by "multi-plexing" the customer lines. Essentially, the 2 Mbit/s stream is divided into 30 "time slots". The information being received for each conversation is "slotted" in the appropriate time slot. The information being transmitted on the 2 Mbit/s stream is transmitted faster than on an individual customer line between the customer and the CMUX, thus 30 such conversations can be accommodated on each 2 Mbit/s stream.

19 A CMUX can also be located in a Telstra exchange building. A pillar is used as a cross-connect point for the connection of distribution cables to the main cables, which are then connected to the main distribution frame at the exchange building housing the CMUX. Typically, there are a number of pillars connected to a CMUX. Below is a photograph of a 900 pair pillar:

'900' TYPE PILLAR AND '9' PIT
CNR AJAX DR & DONALD ST
WHEELERS HILL (27-SEP-2001)

'900' TYPE PILLAR (P85)
CNR AJAX DR & DONALD ST
WHEELERS HILL (27-SEP-2001)
NOTE CABLE TERMINATION STRIPS AND
SPARE PORTS (HOLES) FOR ADDITIONAL
STRIPS (100 PAIRS / STRIP)



'900' TYPE PILLAR (P85)
CNR AJAX DR & DONALD ST
WHEELERS HILL (27-SEP-2001)
NOTE CABLE TERMINATION STRIPS (4 INSTALLED)
AND JUMPERS (RED/WHITE WIRES) CONNECTING
DISTRIBUTION CABLE PAIRS TO MAIN/BRANCH
CABLE PAIRS (ONE JUMPER / SERVICE)
F

The two pictures above show the same pillar with its housing (or covering) removed.

20 Telstra's Customer Access Network (CAN) transmission is typically provided by:

(a) twisted pair copper cable placed in conduits or ducts which are buried in the ground; or

(b) twisted pair copper cable buried directly in the ground.

The customer density within a distribution area will generally determine if the copper cable is placed in conduits or directly buried. The advantage of using conduits is the added protection provided to the twisted pair copper cable, and the flexibility of later adding additional capacity within the conduits or replacing the existing cable with a larger cable.

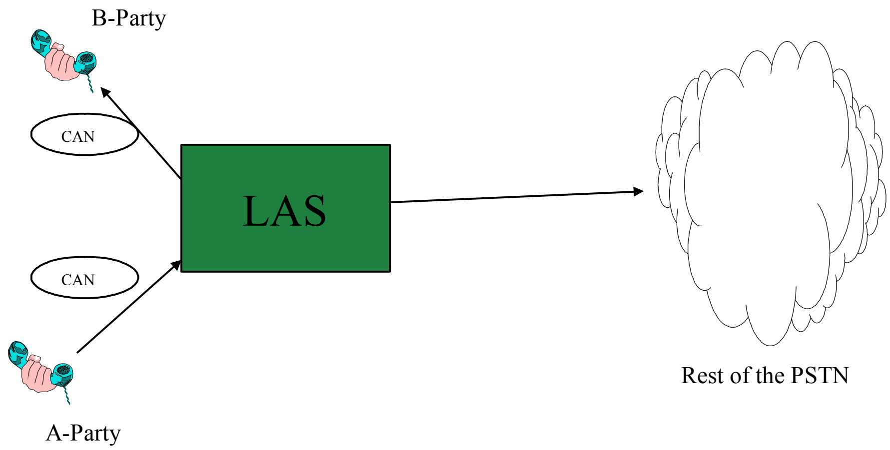
21 The hole dug in the ground in which the conduits or cable is buried is called a "trench". Accordingly, a trench is not a permanent structure as such. However, digging the trench and/or burying the conduit or direct burying the cable is the costly part of building a CAN.

The IEN

22 The IEN consists of the transmission systems connecting the LASs, TNSs (Transit Network Switches), IGEs (International Gateway Exchanges) and IGSs (Interconnect Gateway Switches). The transmission links generally are optical fibre cables, with some radio links providing the connectivity.

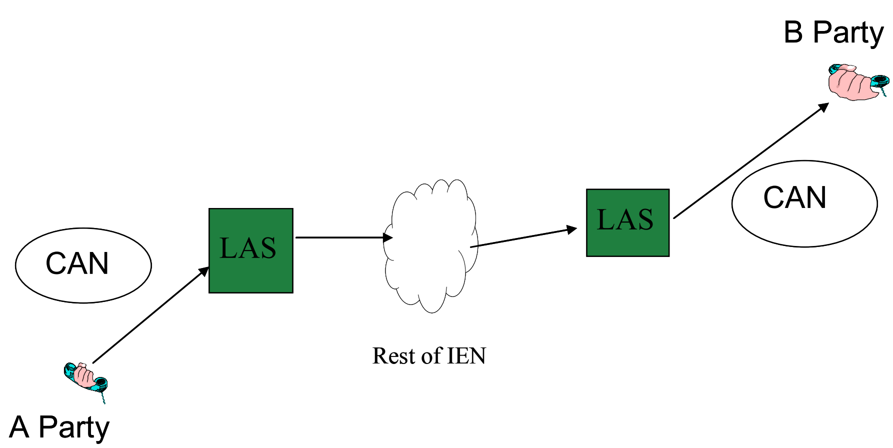
Making a telephone call on the PSTN

23 The simplest possible call is a call between two customers connected to the same LAS. The A-party lifts the handset. This tells the LAS that the A-party wishes to make a call. The LAS responds by sending a dial tone to the A-party. The A-party then dials the B-number. The LAS passes the B-number to the control equipment for analysis and a check to see that the line for the B-number is free, and then signals the switch to connect the two lines. This sends a ring tone to the A-party and a ringing signal to the B-party. The control equipment also creates a call record of the call for billing purposes. This may be illustrated as follows:

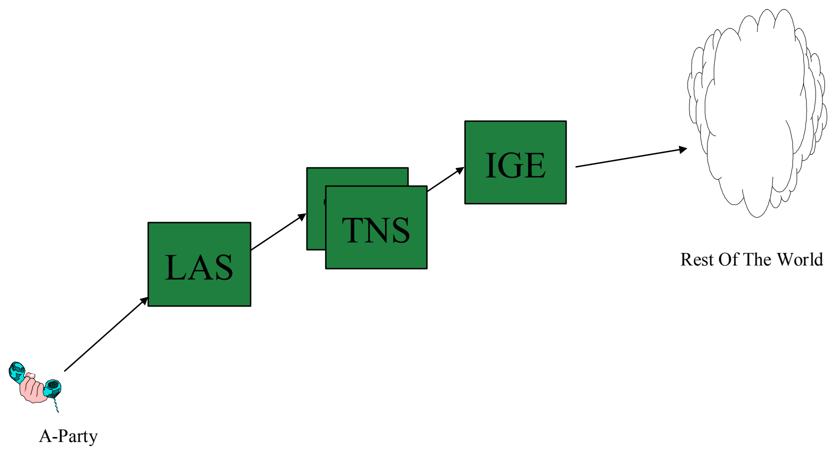


24 The next simplest type of call is from one customer to a customer connected to another LAS in Australia through a single network. This call is likely to be a national long distance call. In this case, the A-party picks up the handset. Again, that tells the LAS that the customer wishes to make a phone call. The LAS sends back a dial tone. The customer then dials the B-number. The LAS passes the B-number to the control equipment which then signals to the LAS to which the B-party is connected (either directly or through TNSs). The control equipment of the B-party switch checks to see if the B-party is free. If the B-party is free then the control equipment signals each of the switches to connect the two lines and sends a ring tone to the A-party and a ringing signal to the B-party. The control equipment in the switch nearest to the A-party creates the call record of the call for billing purposes. The routing intelligence is in the routing tables in the control equipment. The routing tables typically specify that a call should be routed direct to the destination switch if possible, or else it should be routed direct to another switch which acts as a transit switch. If the transit switch receives the call, it consults its routing tables.

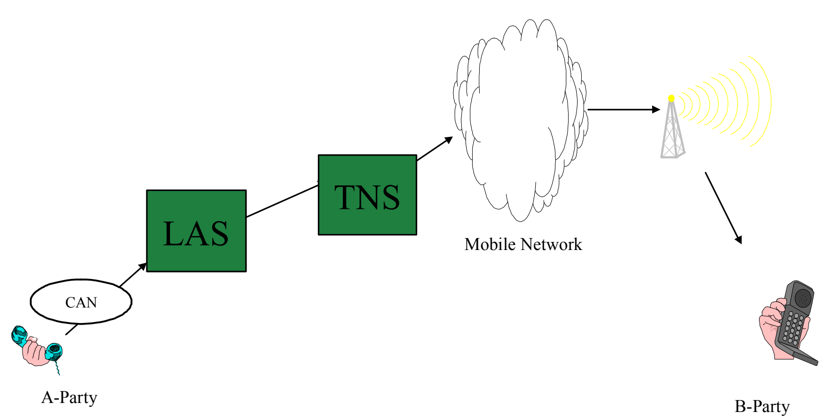
This may be illustrated as follows:



25 For an international call from the PSTN, a Telstra customer lifts the handset and receives dial tone from the LAS. The customer dials the required overseas number, which is sent to the customer's LAS, which then connects the call through one or more TNSs to an IGE, and then to the overseas country.



26 For a call made by a customer connected to Telstra's PSTN to a Telstra mobile service (a "**fixed to mobile call**"), the customer dials the mobile telephone number of the B-party. The call is sent to the customer's LAS, which then connects the call to one or more TNS as necessary. The last TNS connects the call to a mobile switch. From there, the call is transmitted to a mobile tower, and delivered to the B-party's mobile handset by wireless transmission from a base station.



Using the PSTN for High Speed Data Services using ADSL

27 Some parts of the public switched telephone network can be used to provide high speed data services by the use of a special form of digital transmission technology known as Asymmetric Digital Subscriber Line ("**ADSL**"). In particular the CAN twisted pair copper cable can be used for both voice and data transmission simultaneously with the use of a Digital Subscriber Line Module ("**DSLAM**") at the RAU and a filter at the customer end of the line. This filter separates the voice signals which go to the telephone handset from the data signals which go to a modem (usually associated with a computer).

28 The examples above ignore the additional complexities that arise by virtue of interconnection of Telstra's PSTN with fixed switched networks of other carriers in Australia.

Unconditioned Local Loop Service ("ULLS")

29 ULLS enables another carrier to use Telstra's CAN to provide services to customers. The other carrier provides its own equipment which is equivalent of Telstra's LAS and IEN and the copper line between the customer and the RAU is connected to that equipment.

30 This enables the end user customer to make telephone calls or acquire broadband data services in the manner set out above, using Telstra's CAN and the other carrier's IEN.

B. REENGINEERING OF THE PSTN

31 I am informed that the PIE II model has been based upon existing locations of LASs.

32 During the period 1992 to 1999 a process was undertaken which involved a complete re-engineering of Telstra's fixed network to enable the competitive delivery of advanced products and services to Telstra's customers. It was essentially a massive simplification of Telstra's fixed network so as to eliminate all analogue switching technologies and replace them with larger and more centralised digital LASs. The switches used were all best-in-use technology sourced from two of the

biggest world suppliers. The re-engineering process delivered a significant reduction of the number of actual switches and rationalised a number of locations of switches. At the completion of the re-engineering, the number of switches in Telstra's PSTN was reduced from approximately **[c-i-c]** analogue switches to **[c-i-c]** digital LASs with RSS/RSU, IRIM and CMUX used in place of the analogue switches. In my view, approximately **[c-i-c]** LASs is an efficient number of LASs based on the demography of the Australian population and the location of Telstra's existing exchange buildings. If less than **[c-i-c]** LASs were used, the cost of transmission between LASs and RAUs would increase. This is due to the necessity for longer cables, the length of transmission systems and increased transmission capacity.

33 The process was largely completed by 1 July 1999. Upon completion, there was also **[c-i-c]** transit switches established to link the **[c-i-c]** LASs in the PSTN and **[c-i-c]** IGSs (international gateway switches) providing connections and communications services to about **[c-i-c]** operational lines. During this time Telstra also upgraded the inter-exchange-transmission links with the latest digital transmission technology, primarily high bandwidth optical fibre transmission systems.

C. AERIAL PLACEMENT OF TELECOMMUNICATIONS CABLES

34 In today's environment it is very difficult for a telecommunications provider to place aerial cabling consistently throughout the major capital cities and established urban areas in Australia.

35 Prior to 1997 a carrier could roll out infrastructure including aerial cabling with relative freedom due to the fact that the *Telecommunications Act (Cth) 1991* and the *Telecommunications National Code 1994 (Cth)* did not distinguish between underground and aerial cabling. The *Telecommunications Act (Cth) 1991* gave a carrier the power to install all "facilities". "Facility" was defined broadly as:

(a) any part of the infrastructure of a telecommunications network; or

(b) any line, equipment, tower, mast, antenna, tunnel, hole, pit, pole or other structure or thing used, or intended for use, in or in connection with a telecommunications network; or

(c) a facility ancillary to a line link.

36 Even so, while Optus was constructing its aerial cable network in the period 1995 to 1997 there was a significant public outcry against putting aerial cables on electricity any other poles. In 1996, as the *Telecommunications Act (Cth) 1997* was being drafted a new requirement was included to create a distinction between a high impact facility and a low impact facility. For a high impact facility planning approval is now required from the relevant State or Territory administrative authorities or the owner of the land prior to establishing the infrastructure. In the event that the carrier is unable to obtain such approval they may apply to the Australian Communications and Media Authority ("**ACMA**") for a facility installation permit ("**FIP**"). But the ACMA may only issue a FIP in limited circumstances (for example, the telecommunications network to which the facility relates is of national significance). Aerial cabling is considered a high impact facility. I consider it to be practically impossible to obtain local government approval for aerial cabling in the CBD or major metropolitan areas. Annexure B is a copy of the ACMA's *Guide to Applying for a Facility Installation Permit*, May 1999.

37 Furthermore, section 51 of Schedule 3 of the *Telecommunications Act (Cth) 1997* provides that in the situation where, between 2 poles there are overhead cables (and at least one of the overhead cables is a non-communications line), if each of the non-communications cables is permanently removed (either simultaneously or over a period of time) and is not replaced, the owner of the overhead communications lines must, within 6 months after the last removal, permanently remove those lines. Accordingly, it is only in those areas where a power company is using aerial reticulation and intends to continue using aerial reticulation for some time that Telstra could maintain its aerial reticulation with relative certainty.

38 From July 1999 onwards if Telstra wished to rollout its network aerially in a particular area, it would have to issue a project activity notice to the relevant Council. The relevant Council would then have the right to approve and issue a permit or disapprove the aerial cable rollout. To my knowledge there is no time limit on the councils' deliberations.

39 Aside from rural areas, Telstra has aerial cabling for the PSTN in some parts of the capital cities of Australia, for example, parts of Sydney, in the Dandenong Ranges and the Yarra Valley in Victoria. This is where the ground is too rocky or treacherous to allow for underground cabling or the finding of a practical alignment with property and road boundaries was not possible and prevented the provision of underground conduits.

40 There are numerous different regulations and standards published in relation to aerial cabling. In that regard, Annexure C is a copy of the Australian Communications Industry Forum's *Industry Code External Communication Cable Networks* Third Edition ACIF C524:2004 ("**the ACIF Code**"). Section 8 of the ACIF Code sets out the following requirements in relation to aerial cabling:

(a) the minimum clearances to ground in any direction for communications lines are as follows:

(i) over any part of a freeway, primary arterial road, collector road or highway - 5500 mm;

(ii) over any part of a carriageway of a roadway - 5000 mm;

(iii) over land, other than the carriageway of a roadway, traversable by vehicles and machinery - 4600 mm; and

(iv) over land which, due to its steepness, swampiness or other reasons, is not or should not be traversable by road vehicles - 3500 mm;

(b) the minimum clearances to ground in any direction for customer leads are as follows:

(i) over any part of a freeway, highway, or over-dimensioned route - 5500 mm;

(ii) over the centre of each carriageway of a roadway - 4900 mm;

(iii) over any part of a carriageway of a roadway (other than the centre) - 4600 mm;

(iv) over a vehicular crossing of a footpath in a roadway entering a commercial/industrial premises (other than a residential driveway) - 4300 mm;

(v) over a vehicular crossing of a footpath in a roadway for a residential driveway and any part of a footpath, and over land not normally traversable by road vehicles - 3500 mm; and

(vi) on customer premises land or over land which, due to its steepness, swampiness or other reason, is not traversable by road vehicles - 2700 mm;

(c) the minimum clearances from structures of communications cable are as set out in the following table:

Direction from Structure	**Minimum clearance from Structure (mm)**	
	Insulated Communications Cable	Bare Stand Wire
Vertically above those parts of any structure normally accessible to persons	2400	2700
Vertical above those parts of any stricture not normally accessible to persons but on which a person can stand	100	2700
In any direction (other than vertically above) from those parts of any structure normally accessible to persons or from any part not normally accessible to persons but on which a person can stand	100	900
In any direction from those parts of any structure not normally accessible to persons	100	300

41 Generic clearances from electrical power lines for the aerial broadband cable network (used for Pay Television and data services), when measured from the lowest aerial low voltage non insulated power conductor are as follows:

HFC Network

	At the Pole	Mid-span
Low Voltage	750 to 1000 mm	600 mm
High Voltage	2200 to 5000 mm	1700 to 3700mm

HFC Drop

	At the Pole	Mid-span
Low Voltage	600 mm	600 mm
High Voltage	2200 to 5000 mm	1700 to 3700mm

42 Generic clearances from power lines for the PSTN, when measured from the lowest aerial low voltage non insulated power conductor are as follows:

PSTN and PSTN Drop

	At the Pole	Mid-span
Low Voltage	1200 mm	600 mm
High Voltage	2200 to 3000 mm	1800 to 3000 mm

43 A minimum clearance of 300 mm is required between Telstra's broadband network cables and Optus' broadband network cables and a minimum clearance of 100 mm (with 300 mm being the preferred clearance) is required between Telstra and Optus' broadband cables and the PSTN.

44 Given that poles are generally 7 to 8 metres high, and that the lowest cable crossing a road can be at 5 m above the ground, it is clear that there is a limit as to the number of entities that can share a pole and achieve the specified clearances.

45 Telstra owns approximately **[c-i-c]** poles. These poles are mainly situated in rural areas. Approximately **[c-i-c]** % of Telstra's PSTN network is on poles owned by either Telstra or power authorities.

46 Aerial cabling is subject to a Facility Access Agreement with the appropriate utility or carrier governing the necessary work practices as well as the setting of the rental cost per pole.

47 The amount of underground infrastructure necessary to build a network is substantial. This is a photograph of a smaller pit:

and a larger pit:

This is a photograph of the inside of a typical Telstra pit between the customer and a pillar:

PIT OUTSIDE 23 BELINDA CRES, WHEELERS HILL (27-SEP-2001)
CUSTOMER LEAD-IN PIPE AT LEFT, STREET PIPE AT TOP
SMALL PAIR GAIN SYSTEM INSIDE RECTANGULAR CASE

A

and

PLASTIC PIT AT CNR AJAX DR & BELINDA CR,
WHEELERS HILL (27-SEP-2001)
CLOSE UP VIEW OF CONDUIT EXITS AT RIGHT WITH MULTIPLE CABLES I
NOTE CABLE TV COAXIAL CABLE RUNNING VERTICALLY
IN LOWER RIGHT CORNER

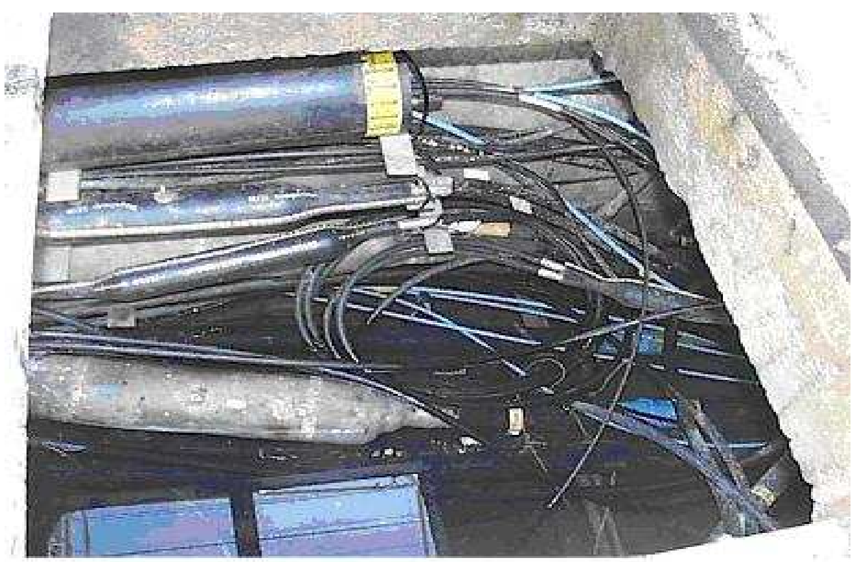
D

In this photograph the ducts are visible.

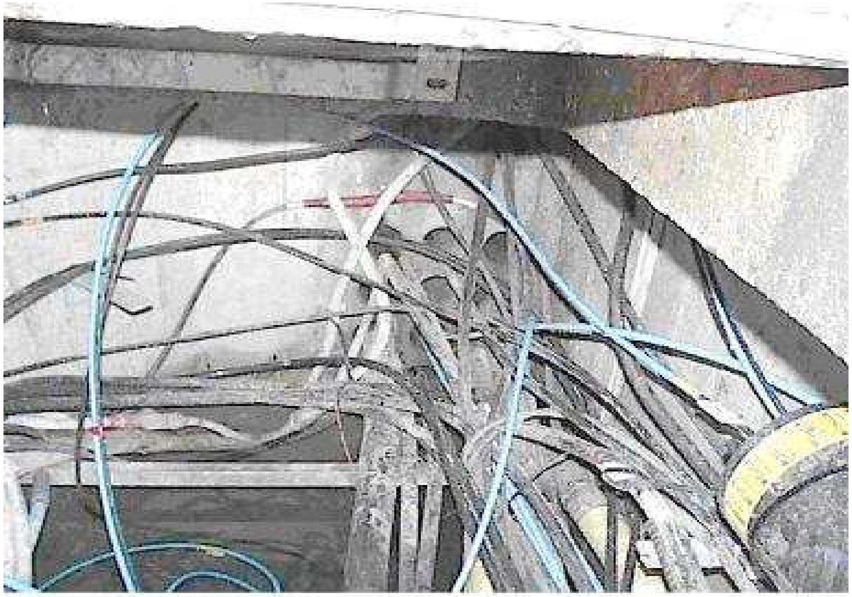
This is a photograph of a typical pit between a customer and a RAU:

MANHOLE NEAR CNR FERNTREE GULLY RD
& LUM RD, WHEELERS HILL (27-SEP-2001)
NOTE COPPER CABLE JOINT ENCLOSURES AND
NUMEROUS SMALLER SIZE CABLES
(REFLECTION OF SKY/PHOTOGRAPHER IN WATER AT BOTTOM)
N

These photographs are of a typical pit between a pillar and a RAU:



MANHOLE NEAR CNR FERNTREE GULLY RD
& LUM RD, WHEELERS HILL (27-SEP-2001)
NOTE OPTICAL FIBRE JOINT ENCLOSURE (TOP)
AND COPPER CABLE JOINT ENCLOSURES (LOWER)
AS WELL AS NUMEROUS SMALLER SIZE CABLES
(REFLECTION OF SKY IN WATER AT BOTTOM)
N



MANHOLE NEAR CNR FERNTREE GULLY RD
& LUM RD, WHEELERS HILL (27-SEP-2001)
NOTE MULTIPLE MAIN CONDUITS WITH LARGE SIZE
COPPER CABLES AND OPTICAL FIBRE
(OPTICAL FIBRE JOINT ENCLOSURE IN FOREGROUND)

N

MANHOLE NEAR CNR FERNTREE GULLY RD
& LUM RD, WHEELERS HILL (27-SEP-2001)
NOTE MAIN CONDUITS AT CENTRE AND LEFT

N

This is a photograph of the cable entering a LAS location:

MORDIALLOC EXCHANGE CABLE CHAMBER (16-SEP-1999)
NOTE MAIN CONDUIT ENTRY AT END OF CHAMBER
AND LARGE QUANTITIES OF LARGE COPPER CABLES
ENTERING AND PASSING UP UNDERNEATH MDF

As is apparent from the above photographs, the amount of cabling necessary to provide a telecommunications network would be difficult to put on poles as aerial cable in a non-intrusive manner.

48 If the amount of cabling necessary was to be reduced, then consequentially there would need to be a significantly higher usage of CMUX equipment. This would facilitate the replacement of copper cable with optical fibre to the pillar. Currently it is not possible to install optical fibre all the way to all of the customers' premises in an economic manner. A CMUX would have to be installed instead of the vast majority of pillars to convert the data which is being transmitted by light waves into electrical signals (which is used for transmission on the copper cable to a customer). The installed cost of a pillar is approximately **[c-i-c]**. The installed cost of a CMUX is approximately **[c-i-c]**. Thus although the cost of providing ducts would decrease, the equipment costs would be substantially greater. Due to the drops required between poles, the length of the cable required would also increase. In my opinion this would result in higher overall costs of deploying the network.

D. CAN (CUSTOMER ACCESS NETWORK) ASSUMPTIONS IN THE PIE II MODEL

49 I have been asked to comment on the appropriateness of certain of the CAN assumptions in Telstra's PIE II Model. My comments are set out below.

The number of distribution pairs per service in operation

50 A SIO (service in operation) is, in the case of PSTN, a single telephone line (being a copper wire pair connected to a customer's telephone or other equipment). Therefore, if a customer has two separate telephone lines, then that customer would have two SIOs. A distribution pair is the name for the copper wire pair connected between the customer's telephone and a cross connecting pillar.

51 In my view the number of distribution pairs per SIO would be **[c-i-c]**. **[c-i-c]** represents the least number of pairs that good engineering practice would require. I set out my reasons as follows:

(a) Consistently with general engineering practice, any efficient operator would provide capacity resulting in about **[c-i-c]** lines per SIO in the PSTN for growth, movement of customers and for faults. I deal with each of these below.

(i) <u>Growth</u>

The PSTN is growing in two ways. The first is the building of new housing, industrial and other estates, which is irrelevant in this context. The second is by increased density of housing in the existing established areas. Often areas increase in density both because extra customers move in (due to subdivision of blocks or building of high rise buildings) and because of customers demand for additional lines.

(ii) <u>Movement of Customers</u>

Telstra currently experiences approximately **[c-i-c]** disconnections and reconnections per annum as a result of movement of customers within the PSTN. The network needs to cope with that change of customer and change of usage. Customers with **[c-i-c]** lines in one location may expect to acquire the same number of lines when they move to new premises. Given the customer service obligations under which any PSTN provider operates (which I discuss in more detail below), Telstra needs to ensure (and any efficient PSTN provider would need to ensure) that customer services are connected within a limited period of time. Generally Telstra could not meet these requirements if it was required to consistently install increased capacity in established areas.

(iii) Faults

Pursuant to Telecommunications Act 1997 and the Telecommunications (Consumer Protection and Service Standards) Act 1999, the ACMA imposes minimum customer guarantee obligations on PSTN providers requiring them to fix faults within a relatively short period of time. The stringency of these obligations is heightened by the giving by PSTN providers of additional guarantees in respect of customer services. These guarantees are of the kind which efficient PSTN providers give. For some faults generally associated with damage, age or water ingress in a cable, the easiest way to fix the fault in the line may be to replace it with a different line. In some circumstances, to fix a line would require the line to be dug up, and the fault located and fixed. This would take much longer than the time allowed under the customer service guarantees. Accordingly prudent, efficient planning necessitates the availability of additional lines.

(b) As mentioned above, any PSTN provider operates under customer service guarantee obligations which, in Australia, are imposed upon it by the ACMA pursuant to the relevant legislation. Those obligations require Telstra to connect customers and fix faults reported by customers in short periods of time. By way of example, all things being equal, a fault reported by a customer in the urban area must be fixed within one working day. These obligations would be impossible to meet if there were no spare capacity in the network. If no spare lines were available, a service could be provided to a customer in two ways (not including radio or satellite solutions):

(i) by installing an electronic pair gain system; or

(ii) laying more cable.

If new cable is required and there is not enough space in the duct or associated pits then it will take some time to provide additional capacity given the requirements to contract with a contractor to do the work, and the contractor acquiring the appropriate materials and trenching or boring equipment and, in some cases, obtaining permission from the relevant Council to dig trenches. An electronic pair gain system that provides the capability to connect many customer services to a few copper pairs is a viable alternative. Essentially it is equipment which enables one twisted copper cable pair to be used by more than one customer to make calls simultaneously. An electronic pair gain system can often be installed within the required timeframe. However the service quality provided to a customer and the ability of the customer to transmit data may be adversely affected.

(c) The less spare cable pairs that are provided in the network, the more operational and maintenance costs increase. As set out above, additional copper pairs can be added by two means.

First, an electronic pair gain system can be installed to provide an extra line to a customer. Installation of an electronic pair gain system costs in the order of:

(a) about **[c-i-c]** for a fully installed two pair gain system;

(b) about **[c-i-c]** for a fully installed eight pair gain system.

Second, an extra cable can be laid down. If a conduit is available through which a cable can be threaded the cost will be less than if extra conduits must be installed. However, if a new conduit is required then the cost of provisioning and installing conduits, cable, and other materials can cost up to **[c-i-c]** for relatively short distances of say 500m.

(d) The resultant outcome of about 2.0 copper pairs (on average) per SIO is consistent with:

(i) provisioning and deployment rules used by Telstra;

(ii) provisioning rules used by other large established telecommunications companies worldwide.

The resultant outcome of about 2.0 copper pairs per SIO is an average. Telstra's provisioning rules are not an average but rather are rules to choose a minimum cable size which is appropriate to be installed given the number of living units in an area. A living unit is a house or an apartment, which may have more than one SIO connected. The manner in which this provisioning would be calculated using Telstra's rules is that assuming that there were 50 living units in the area, the provisioning rules would require at least 100 copper pairs to be installed (using the rule of two pairs per living unit). Cable modularity establishes that a 100 pair cable is the closest cable size. Accordingly a 100 pair cable would be installed in that area. If there were only 30 living units in the area, similarly a 100 pair cable would be used. The planned utilisation rate of the cable to living units, using the first example would then be 50%. However, depending on the services take up by customers initially and over time, the actual utilisation rate would be much higher. Furthermore, the utilisation rate of the cable would increase as blocks were subdivided or if additional living units were added in areas previously not included in the initial development.

Pillars

52 The standard size pillar used by Telstra is a 900 pair pillar as this provides the optimum plant configuration to serve a distribution area, allowing for growth and enabling Telstra to achieve a standardised network layout.

53 A standard 900 type pillar is capable of cross connecting up to 900 copper pairs in 9 x 100 pair tails. I consider that good engineering practice requires that one of the tails should be left as a spare in case one of the used tails fails or is damaged over time and needs to be replaced. This makes repairs easier because if one pillar tail fails all customers connected to it can simply be swapped to the spare one using no-

break connection techniques. Each of the tails is dedicated to either the distribution or the network side of the pillar. I consider that, in conformity with good engineering practice, generally 5 pillar tails should be assigned to the customer side and 3 to the network side.

Assumptions Relating to Service of Remote SIOs

54 I am advised that the PIE II model assumes that servicing of remote SIOs may utilise technologies other than twisted pair copper cables, based on the following specific assumptions, all of which are consistent with the current Telstra deployment rules:

(a) all Distribution Areas ("**DA**") that are less than 6km from the nearest RAU are connected to the nearest RAU using copper main cable;

(b) the maximum copper distance from a RAU to a non-urban DA is 6km;

(c) a satellite service is not considered for isolated SIOs in DAs that are served by copper;

(d) a satellite service is used if there are less than 15 SIOs in a DA;

(e) all other DAs are serviced by one of the following:

(i) small capacity distributed system ("**SCaDs**"); or

(ii) -single/dual channel access radio systems ("**SCARS/DCARS**"); or

(iii) high capacity radio concentrator systems ("**HCRC**").

55 A SCaDS is a Small Multiplexer which connects up to a total of 30 lines to small groupings of customer at some distance from the RAU. I consider that a minimum 20% spare capacity in SCaD lines for each system is reasonable in order to allow for growth in the total of SIO's.

56 The HCRC is a point-to-multipoint system which is designed to provide service to isolated clusters of customers. The HCRC system uses digital repeaters allowing large geographical areas to be covered. Hence customers located several hundred kilometres from the radio base station can be connected. Where HCRC is used, it is

deployed in all the DAs served by radio in a given ESA, even though they may be at opposite ends of the ESA.

Satellite services

57 The satellite service cost per SIO is at least $70,000. A satellite installation complying with the STS typically comprises a pole mounted antenna with equipment housed in an adjacent outdoor shelter. The shelter is ground mounted and can vary in size

RAU Dimensioning

58 I am advised that the following rules and assumptions have been adopted in the PIE II model in relation to the dimensioning and costing of RAU's which I consider to be reasonable:

(a) all RAU's use CMUX technology which is the best in use technology even though the network models restricted to voice, leased lines and ISDN and does not include any broadband component;

(b) there are 2 types of CMUX which are used, including network units ("**NUs**") which are mounted internally in a RAU location (telephone exchange building) and access units ("**AUs**"), which are mounted internally in the RAU location or as above-ground housings ("**AUs**") located in metal cabinets adjacent to the footpath in the street.;

(c) generally, AUs serve all services that are connected to a pillar provided the pillar is located within 4km of the RAU location. All other services are served by CMUXs in the street cabinet configuration;

(d) all CMUXs in the AU configuration need to be supported by NUs and all remote CMUXs are connected to their parent NUs using optical fibre.

59 In addition to the above, I am advised that the model assumes that a maximum 80% of the capacity in each CMUX is available for use. I consider that to be reasonable as it allows spare capacity for maintenance and growth in services in the future.

Miscellaneous Issues

60 In the CBD areas of the capital cities large size main cables serve the large buildings directly with a number of buildings connected via the one cable. With the number of services required in the CBD the main cable lengths are typically less than **[c-i-c]**.

61 The planning of a DA ensures that the initial provisioning of cable and associated plant is done in the most economic way and also in a way that allows for future planned growth. In my view, all DAs should be connected via a pillar acting as a Cross Connection Unit. The most economic layout is to use a pillar to serve between **[c-i-c]** services in a DA.

E. NETWORK MODERNISATION

62 I have detailed knowledge of the planning, design, operation and operation and maintenance of Telstra's customer access network and the rationale for any maintenance or upgrade of that network. I also have detailed knowledge of technical and operational aspects of Telstra's ULLS.

63 I have been asked to comment on:

- the rationale for network modernisation (that is the ongoing maintenance and upgrade of Telstra's network);
- the effect of any delay in network modernisation on Telstra and end-users; and
- the impact of network modernisation on wholesale customers.

Rationale for network modernisation

64 The ongoing maintenance and upgrade of Telstra's network is required to enable Telstra (and other users of Telstra's network) to meet the demands of Australian end-users for telecommunications services and services supplied by means of telecommunications services at present and into the long term.

65 When making decisions on when and how to modernise the Telstra network I take into account the existing, changing and future demand for services and the ability of the network and technology deployed to meet that demand in terms of location, quality and quantity of services. I also endeavour to ensure that network infrastructure is allocated in the most economic and efficient way to meet that demand.

66 In many parts of Telstra's network the relocation of customer access modules from traditional exchanges buildings to locations closer to end-users (such as by installing RIMs or CMUXs in street locations closer to customers) and the replacement of twisted pair copper cables with fibre optic cable is required in order to meet minimum service standards for basic telephone services and to provide access to broadband data services to end-users.

67 Where relocation of a customer access module occurs, the maintenance of copper between a traditional exchange building and the location closer to the end user would result in additional ongoing maintenance and repair costs to Telstra.

68 Without any maintenance or upgrade of Telstra's network parts of the network would fall into disrepair and the network's design and capabilities would not match changes in demand and location of Australia's population.

69 Because of the increasing misalignment between Telstra's traditional exchange-based copper network and end-user demands (including end-user broadband demands), continuing investment in traditional exchange-based infrastructure is not efficient where it would not result in meeting those end-user demands.

70 In my view, network modernisation is necessary as without any upgrade of Telstra's fixed line network over two thirds of Australian end-users will never be able to access higher speed broadband data services in excess of 10Mbit/s over this fixed line network.

Effect of delaying network modernisation

71 Delays due to notice periods in excess of the time within which Telstra can plan and implement a network upgrade will constrain the ability of Telstra to meet the demands of end-users of telecommunications services. In a number of cases, non-

emergency maintenance or upgrades to Telstra's network could be planned and implemented within 4 weeks.

72 During a delay to any maintenance or upgrade of Telstra's network (other than in the case of some emergency network upgrades), the network's design and capabilities would not match the demands of and location of Australia's population.

73 The effect of any delay to a network upgrade project would need to be evaluated in planning for network upgrades, and may result in some projects no longer being commercially viable.

74 Where network maintenance or upgrade of Telstra's network is necessary as a result of an emergency it is accepted in the industry that it may not be possible to provide the same period of notice that would be provided if no emergency existed. Network integrity is a widely understood term in the industry. It is commonly understood in the industry that network maintenance or upgrades required to protect the security or integrity of a network constitute an emergency.

Impact of network modernisation on wholesale customers

75 Network maintenance or upgrades of Telstra network are usually planned and implemented at a DA level. I understand that the majority of roll-outs of infrastructure by wholesale customers have occurred at exchange buildings. Due to the ratio of DA to each exchange building, a network upgrade at a DA level is unlikely to have a significant impact on the viability of infrastructure deployed at an exchange building.

76 If a wholesale customer cannot or chooses not to relocate they will be able to arrange an alternative service for their end-users within 15 weeks.

77 Altering design and planning for network maintenance and upgrades to minimize impacts on the deployment of infrastructure by wholesale customers would lead to inefficient network design and an increase in project costs.

F. PUBLIC SWITCHED TELEPHONE NETWORK-EQUIPMENT

78 **[c-i-c]**

Dated: **4 August 2006**

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<u>Annexure A – **[c-i-c]**</u>