B6
Telecommunications

Guiding principles

Access and equity: Access to services involves both household facilities and centralised public facilities. All households in the community should have ready access to a basic telephone service (preferably within the house itself). Services should also be provided for groups with special needs (such as elderly, disabled).

Health and safety: Telecommunications services are lifelines for remote communities, often playing an integral role in emergency situations. Adequate communications coverage is required for emergency and essential services between a community or regional centre and its service satellites.

Environmental health: Some telecommunications infrastructure has potential consequences for public health and safety (such as electromagnetic radiation) that should be considered when planning and installing services.

Appropriateness: The following factors should be considered when selecting appropriate telecommunications infrastructure for remote communities: robustness, location, availability, expected lifetime, capacity requirements and environmental impact.

Affordability: Up-front capital costs (for example, costs for designing, procuring and installing infrastructure) and costs for operation and maintenance (such as costs for ongoing building, heating, cooling and equipment power costs, spare parts and maintenance contractors) should be taken into account when selecting telecommunications infrastructure and services for remote communities.

Sustainable livelihoods: Maintenance and provision of high-quality telecommunications infrastructure is vital in remote areas, given the low population density, and the high cost and limited availability of other means of communication and transport (for example, roads, public transport, railways, air services).

Systems overview

The basic components of telecommunication services are user equipment (telephones, computers, mobile phones and radios) and networks (linking the user equipment). Different technologies and implementation approaches are used for each application.

Telecommunications networks should also be considered in terms of:

■ local networks within the community

■ connectivity to external networks, national and international.

Technologies used in remote communities are often different from those used in urban and regional contexts. At the community level, wireless technologies (such as Wi-Fi; Worldwide Interoperability for Microwave Access, or WiMax) or various forms of copper cabling are typically used. Connection to external networks usually requires high-capacity long-distance technologies, such as optical fibre cable, high-capacity microwave radio systems or satellite links.

Current service delivery arrangements

Telecommunications services are regulated on an Australia-wide basis. State and territory or local authorities do not regulate or operate telecommunications services, other than at a town planning level.

The Australian Government Department of Broadband, Communications and the Digital Economy (DBCDE) is responsible for administering the *Telecommunications Act 1997* and the *Telecommunications (Consumer Protection and Service Standards) Act 1999*, and funds a number of schemes to support services in remote and sparsely populated areas that would not otherwise be available at a reasonable cost from the open market.

Regulatory functions are shared by the Australian Communications and Media Authority (ACMA) and the Australian Competition and Consumer Commission (ACCC):

■ ACMA is responsible for the regulation of broadcasting, internet, radio communications and telecommunications, including performance and safety standards.

■ ACCC regulates competition, access arrangements and pricing for bottleneck services (for example, access by other carriers to Telstra's network facilities) in the telecommunications industry.

Relevant legislation

- *Telecommunications Act 1997* (Cwlth)

- *Telecommunications (Consumer Protection and Service Standards) Act 1999* (Cwlth)

- Telecommunications (Low-impact Facilities) Determination 1997 (Cwlth).

A telecommunications carrier (such as Telstra) licensed by ACMA is usually responsible for implementing telecommunications services including public phones, private phones and mobile network infrastructure. When providing a standard telephone service, the carrier incurs a regulatory obligation referred to as the Customer Service Guarantee (CSG). This means that they are obliged to provide basic services of a certain quality and they must rectify faults within the timeframes specified in the CSG. If the telecommunications carrier does not comply with the CSG, they can be penalised, and customers can claim compensation.

The Telecommunications Industry Ombudsman (TIO) provides a dispute-resolution scheme for small business and residential consumers who have a complaint about their telephone or internet service.

Universal Service Obligation

The Universal Service Obligation (USO) is a legislated scheme that ensures standard telephone services and public payphone services are available to all Australians on an equitable basis. It is particularly relevant to remote areas, where provisioning and operating costs are high and exceed the revenue earned.

Telstra is designated as the Universal Service Provider under the USO, and is funded by contributions from all telecommunications providers. Telstra is also required to offer USO customers access to an interim service if there is an extended delay in connecting or repairing their standard telephone service.

Performance outcomes (such as operating data rates) for remote area customers often lag behind those in the cities. Those in remote areas are also less likely to have access to telecommunications services than those in urban areas, and many remote Indigenous communities do not have access to public phones (Table B6.1).

Table B6.1: Number of remote Indigenous communities with access to public phones

State/ territory	With access (% of surveyed communities)		Without access	With unknown access status	Communities surveyed
NT	347	(54)	224	70	641
WA	163	(60)	94	14	271
Qld	54	(44)	63	7	124
SA	50	(55)	29	12	91
NSW	14	(25)[a]	43	0	57
Vic/Tas	2	(67)[a]	1	0	3

a   Small sample size
Source: ABS (2006) CHIN survey / ACMA

Relevant Australian standards and guidelines

Guidelines and standards	Topic
AS/ACIF C524:2004	Industry code — external telecommunication cable networks
AS/ACIF C564:2004	Deployment of mobile phone network infrastructure
AS/ACIF S009:2006	Installation requirements for customer cabling (wiring rules)
AS/NZS 4536:1999	Life cycle costing — an application guide
IEC standard 60529	Degrees of protection provided by enclosures (IP code)

ACIF = Australian Communications Industry Forum; AS = Australian Standards; IEC = International Electrotechnical Commission; NZS = New Zealand Standards

Involving the community

Community residents should be involved in the design and maintenance of their telecommunications facilities, particularly in terms of:

■   placement of public facilities so that users have ready physical access to them, but also privacy and security so that they feel comfortable using the equipment; in the case of computing facilities, this includes creating an effective learning environment

■   choice of location so that other community activities are not disturbed or disrupted, and cultural considerations are addressed

■   provision of appropriate security for the equipment

■   incorporation of the facilities in broader community plans and backup strategies for emergencies

■   accounting for special needs of disabled and older members of the community.

In the case of local radio broadcasting services, community members may also have opportunities to participate in studio production operations and technical support.

Because public communications facilities are lifeline services, education and training should be provided for these services. This process can also encourage ownership and ensure that faults are reported promptly to the appropriate maintenance person or channel. Training should also explain the effective use of the facilities, and safety aspects, particularly if the associated equipment is mains powered.

Appraising community needs

Key factors for determining the requirements for any telecommunications service should include the following factors.

Importance or availability

The availability of a service is the amount of time it or a piece of equipment is fully operational as a percentage of total time.

Service availability is determined by the reliability of the equipment or service, and the time out of service when a failure occurs, including the maintenance response time.

Availability can be improved if multiple services operate in parallel. For example, the risk of a community being without a lifeline phone service is significantly reduced if two public phones are provided.

Ensure that:

■   the impact of 'down time' is considered: identify how long the community can afford to be without each service should a failure occur.

Scoping

For a community facility, take into account service areas and functions such as equipment rooms, kitchens, reception areas, fax machines, alarm connection, tie circuits to other nearby organisations (direct telephone circuits that do not connect via the public phone network), emergency channels and public address connections.

Consider:

■   the expected lifetime of the service

■   the capacity requirement (how many channels or circuits, telephones or access points are required).

Location

Consider:

■ where to place user equipment (such as balancing access and privacy issues for public phones)

■ site availability, including access to electrical power and a suitable location for batteries

■ the need for trenching and cabling for cable-borne services

■ placing radio antennae to maximise coverage for mobile services and, where required, radio links to a carrier's network.

Emergency plans

Community planning should take into account how each of the telecommunications facilities (fixed phones, satellite phones, satellite internet, radio and mobile phones, if applicable) may serve as a backup for the others in an emergency. This means a lesser level of availability will be required for each individual service, minimising costs.

Ensure that:

■ telecommunications services are incorporated into the community's emergency plan

■ planning for extreme weather events includes communications equipment and sources of information (such as cyclone tracking websites, and flood and bushfire warning systems)

■ documentation showing important phone numbers, how to access communications facilities in an emergency, and appropriate procedures to be followed in an emergency is displayed in prominent locations

■ the emergency plan specifies how existing telecommunications services will be used; it may also provide for the procurement of additional equipment to be used only during emergencies.

Flexibility

As with any technology, the cost of providing additional capacity for projected growth is lower at the time of initial procurement. Service providers can provide information to assist with making decisions about expanding capacity.

Ensure that:

■ allowance is made for future services and growth when choosing appropriate technologies and equipment types, and when determining the size of equipment or services

■ advice is sought from relevant service providers regarding existing infrastructure (exchange equipment, communication link capacity, cabling, etc) and its capacity to accommodate the extra services.

Environment

Environmental conditions can have a substantial impact on the performance of equipment.

Ensure that:

■ the capacity of equipment to tolerate local environmental factors is specified and quantified where possible

■ equipment operates well within its rated temperature range, through appropriate design of containers, and passive or active cooling mechanisms

■ the location and type of building or tower housing the equipment is chosen to minimise the risk of damage or failure due to flooding, rain damage, or marine or other corrosion.

To minimise entry by insects, moisture and dust, **consider**:

■ sealing points of cable entry to buildings and equipment

■ providing door and window seals

■ using chemical or other methods to protect equipment.

To minimise damage by or to other community activities, **consider**:

■ locating mast guy wires where they will not interrupt the flow of foot traffic

■ protecting mast guy wires and making sure they are visible

■ locating equipment in huts and cabinets to minimise the danger of damage from vehicular traffic

■ protecting equipment from damage by animals, particularly large feral animals (for example, camels and horses).

Privacy and security

Information storage and protection, and security of access and equipment are essential in any community.

Ensure that:

■ community training and education in the appropriate use of passwords and personal identification number (PIN) codes is provided.

Consider:

■ safe storage of private and sensitive information; special arrangements may be required to protect culturally sensitive information

■ the need to control access to prevent theft of services.

Emergency and essential services

A community is likely to have requirements for guaranteed communications coverage throughout its operating area (including travel between the community and its service towns) for emergency and essential services. If the terrestrial mobile phone or mobile radio coverage is not continuous, satellite phones will be required.

Consider:

■ whether portable hand-held or vehicle-mounted units will best meet the needs of the community.
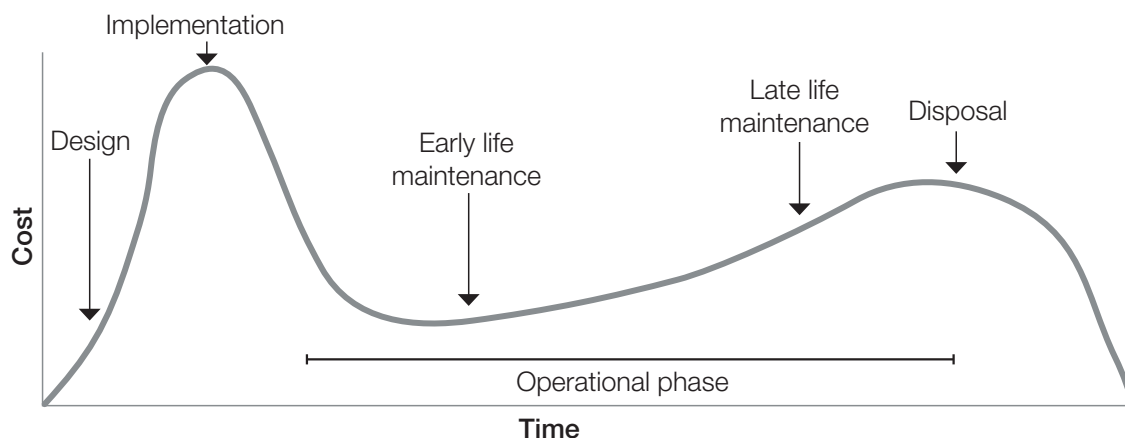
People with disabilities

Consider:

■ the needs of community members and visitors with mobility, speech, hearing or sight impairments and limitations.

Life-cycle costing

Life-cycle costing is the calculation of the cost of infrastructure over its life — from design to disposal (Figure B6.1).

Figure B6.1: Life-cycle costs for telecommunications infrastructure

Source: Centre for Appropriate Technology, 2009

Ensure that:

■ up-front capital costs (such as design, procurement and installation) and operating and maintenance costs (for example, ongoing building space, heating, cooling and equipment power costs, spare parts and maintenance) are calculated.

Documentation

Design and operational parameters, and evaluations should be documented and securely stored.

Ensure that:

- design and operational documents are securely stored and accessible
- planning and design decisions are recorded to save 'reinventing the wheel'
- operational documentation is of a high quality and relates to the actual equipment installed, including labelling for plugs, sockets, cables and switches.

Choosing appropriate solutions

Telecommunications service options in remote communities might include:

- public payphones (telephones provided throughout Australia for use by the general public)
- community phones (telephones provided solely to Indigenous communities, and intended primarily for use by community members)
- private phones
- mobile phones
- mobile radio
- computer networks
- broadcast radio and television.

Technical aspects of design will typically be the domain of network operators (carriers), service providers or equipment and cabling suppliers.

Telephones

Telephones may be private or public and mobile or static, depending on community need.

Public phones

Public phones in remote communities perform a 'lifeline' function — often there are few or no telephones in private homes and no mobile phone coverage. Most public phones are public payphones installed and maintained by Telstra. Community phones have also been installed in some Indigenous communities and outstations. Table B6.2 compares these two classes of telephone service.

Table B6.2: Remote community public phone services

	Public payphone	Community phone
Number of units installed	949 (approx)	236
Payment method	Coin, prepaid smartcard or prepaid PIN card	Prepaid PIN card only
Free emergency and 1800 calls	Yes	Yes
Telephone provisioning and maintenance	Telstra	Telstra or government contractor
Eligibility	50 or more residents	Based on need; a few families

Note: Includes all Telstra-supplied payphones in remote Indigenous communities whether supplied commercially or under the Universal Service Obligation.
Source: ACMA (2008)

Payphones

Payphones can only be connected to a network by a telecommunications carrier. They may be installed and maintained by commercial service providers other than Telstra, such as the suppliers of goldphones, bluephones and equivalent products (Figure B6.2 shows some examples). Payment for calls can be made by coins, prepaid smart cards, credit cards and prepaid PIN cards.

Figure B6.2: Typical public payphones

Source: Centre for Appropriate Technology, 2009

Under the USO, Telstra is obliged to provide a payphone facility to communities with a permanent population of more than 20 adult residents or more than 50 people in total, subject to the proximity of other payphone services and the site's accessibility to customers and maintenance staff. If a community is eligible for a public payphone, it must make a written request to Telstra. Telstra is required to repair faults in its payphones within three working days.

Telstra is also required, under the USO, to provide appropriate assistance in the form of special products and equipment modifications to improve physical access for disabled customers.

Ensure that:

- the needs of older community members and people with disabilities are identified for new and existing services, and documented with the service provider.

Design and installation

Ensure that:

- the community is involved in deciding the location of a new USO public payphone service
- access to mains power is available to operate the payphone and to supply cabinet lighting.

Consider:

■ reducing the cost by locating the payphone as close as possible to existing telecommunications cabling and mains power

■ locating the payphone strategically to minimise the risk of misuse and vandalism.

Operation and maintenance

Most problems with public payphones are due to coins jamming or a full coin box. Prompt reporting of problems to the carrier will minimise outage time. Carriers provide a specific freecall phone number to call in the event of payphone faults or full coin boxes.

Ensure that:

■ community members are encouraged to report faults promptly.

Consider:

■ arranging with the service provider for a community-based contractor to empty coin boxes.

Community phones

Community phones provide an alternative to coin or smartcard public payphones in Indigenous communities. They have no coin mechanism or card reader, and require the use of a prepaid card with a PIN code. This reduces capital and maintenance costs, making them suitable for use in remote areas.

They may be mounted on an external building wall or in a shelter (remote area cabinet, or RAC) in an accessible public place (Figure B6.3). They do not require an electrical supply for their operation as they are powered from the network line.

Community phones are provided, installed and maintained under a targeted Australian Government funding program. To be considered for the installation of a community phone, community members should provide an expression of interest in writing to the Indigenous Telecommunications Development Section of the DBCDE.

Figure B6.3: Community phone and installation in a remote area cabinet

Source: Centre for Appropriate Technology, 2009

Design

The primary design consideration for a community phone is its location in the community.

Ensure that:

■ the telephone is located so that community members can hear incoming calls

■ compatible prepaid cards (Country Calling and Phone Away cards) are available to buy from a local sales outlet (such as community store, nearby station store)

■ special needs of older community members and people with disabilities are identified.

Consider:

■ cabinet mounting for clear and visible access for all community members

■ mounting on a building wall for greater privacy and personal safety— with suitable eaves cover for weather protection

■ locating the telephone strategically to minimise the risk of misuse and vandalism.

Operation and maintenance

Community phones share a simple and robust design; the instrument is a widely used consumer handset and the handpiece is common to Telstra-supplied public payphones. A fault in the telephone itself can usually be addressed by replacing the instrument or handpiece.

If spare parts and tools are available on-site, maintenance can be undertaken by trained members of the community. Otherwise, repair at all Australian locations can be requested through the Telstra Indigenous Directorate office in Darwin.

Private phones

Individual telephones may be provided to private houses in a community, but if a community organisation requires more than one or two telephones, it is usually more cost-effective to provide a telephone system (see below) to share the lines that connect to the carrier's network between the telephones. Calls can then be made between members of the organisation without incurring carrier call charges. These telephones can share their own internal numbering or naming scheme (extension numbers or equivalent) and other facilities.

Services for individual community members

Ensure that:

■ phone service plans are selected to meet each customer's pattern of use — some plans (such as Telstra InContact) offer reduced line rental, but with eligibility conditions and restricted outgoing call access.

Telephone systems

Institutions such as council administrations, health centres, police stations and schools typically require telephone and computing systems.

Ensure that:

■ the mix of required primary functions (telephone, fax, modem and high-speed data) is considered carefully, as this will affect the choice of system

■ the number and placement of telephone extensions is identified

■ requirements for special facilities are documented

■ the number of outgoing and incoming telephone calls, and their expected duration, is estimated to help determine the number of network lines required

■ battery backup capacity is specified in hours — telephone services must be available if mains power fails, to coordinate emergency services; 4 hours is a common choice, but greater backup capacity may be required in some cases (for example, unreliable mains electricity supply; extreme weather events).

System type

Telephone systems fall into two broad categories:

■ traditional private automatic branch exchange (PABX) or key systems for small office telephone systems (up to approximately 10 extensions), where the external exchange lines use the same technology and cabling as individual telephone services

■ Voice over Internet Protocol (VoIP) systems, where the internal and external network connections use data communications technologies.

Telephone and computing functions have traditionally been implemented as separate systems, but current VoIP technology enables both to be implemented in a common data communications system.

Ensure that:

■ a specialist telephone system supplier is consulted for advice on the appropriate system to meet community requirements

■ the relative merits of each approach are compared, including

  - maintenance issues
  - existing investments in equipment and cabling
  - reliability — the advantages and disadvantages of a single system approach
  - operation when the mains electricity supply fails
  - access to the emergency phone number, 000.

Handset type

Two broad classes of handset are available:

■ standard handsets that can be connected as an extension phone or direct to an exchange line (may include cordless phones)

■ proprietary handsets that have special features, such as hands-free operation, stored number calling and incoming calling number display; these handsets are only compatible with a particular manufacturer's telephone system or equipment, and cannot be connected directly to a standard exchange line.

Consider:

■ handset options with your specialist system provider

■ customer equipment and services for people with disabilities, such as

  - handsets with large numeric keys
  - telephone typewriter (TTY) equipment
  - handsets with high receiver volume and a volume control knob.

Installation

Only a carrier can provide network connection for a private telephone service or telephone system.

Consider:

■ although a carrier will supply the first telephone on an individual telephone service, responsibility for supplying additional telephones or other equipment lies with the customer

■ although the customer can provide approved telephone instruments (such as in a home situation), telephone systems are normally installed by the system provider.

Telephone and telephone system cabling

The carrier provides cable connection from its network to a network termination point or network boundary, which is the boundary between its own and the customer's areas of responsibility, including repairs.

If telephone cabling into the building is already in place, the boundary is usually defined:

■ as a **private residence**: the first telephone socket (telecommunications outlet or TO) in the house (see Figure B6.4)

■ as **business premises**: the main distribution frame, a telephone cable connection panel

■ **in other cases**: a small plastic connection box mounted on an external wall.

Figure B6.4: Typical cabling for a residential connection
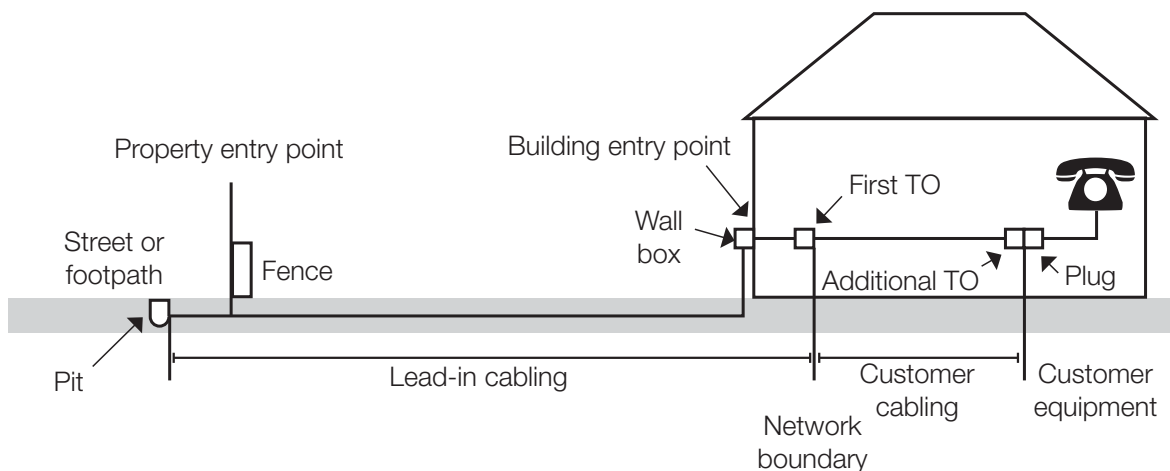
TO = telecommunications outlet
Source: Australian Standard AS/ACIF S009–2006 (www.commsalliance.com.au)

If a community member or organisation applies to have a new private telephone service installed where there is no existing carrier cabling to the building, the customer may be responsible for trenching and cabling. Property and network boundaries may be poorly defined in some remote communities, so the nearest existing Telstra connection point may be taken as the boundary.

Consider:

- the carrier arranges and pays for new cabling on the network side, and the customer arranges and pays for cabling on the customer side

- a registered cabler must install the cabling, but others, including community members, may do preparation work, such as trenching

- cabling inside buildings is the responsibility of the customer (but still requires a registered cabler to install it).

In-building (customer) cabling

The two types of in-building cabling are:

- conventional copper wire telephone cabling: suitable for telephone, fax and modem signals, but not for computer data

- data cabling (unshielded twisted pair, or UTP): a modern, high-precision form of copper wire cabling, which can carry telephone or computer data or both. UTP cables are recognisable by their colour-coded sheathing (generally bright blue). UTP is terminated at the user end on a wall socket.

Where community resources are used to trench for new buried cabling, ensure that:

- extreme care is taken to avoid existing sewer, water, power, gas and telecommunications services

- community and service provider reticulation records are consulted before digging

- new cable is buried at the required depth and separated from other services

- community records are updated to record the exact location of the new cable.

Consider:

- locating new telephone facilities close to an existing pit or pillar, to reduce costs to the community of trenching and cabling.

Cable separation

Ensure that:

- all telecommunications cables are separated by a specified distance separation or a barrier from mains electrical cabling for safety purposes, and to prevent interference from mains-operated devices.

Call accounting

A call accounting system is an optional component that enables the telephone system manager to monitor traffic patterns, individual or group phone usage, and outgoing call costs. It can also assist with the distribution of call costs to organisational cost centres, and with checking carrier or service provider bills.

Configuration changes

Most telephone systems allow the system manager to change system parameters (extension numbers, recorded voice messages, etc) through an attached or remotely connected computer terminal.

Case study 13 — Applying for a community phone

A remote outstation community in the Northern Territory, about 250 kilometres from Alice Springs, had 80 permanent residents. Until recently, the community relied on a single Telstra public payphone, the maximum entitlement under the Universal Service Obligation payphone provisions. This was installed some years ago at one end of the outstation outside its sole community building.

Through the DBCDE Community Phone Project, the community applied to install a community phone to complement the existing payphone, with the assistance of a local resource agency.

The community cited the following factors in its application:

- *The widely dispersed houses and the size of the community made access to the payphone difficult — older community members, living 500 metres or a 10-minute walk from the telephone, could not receive incoming calls.*

- *There is no mobile phone coverage and the nearest community with a telephone was about 70 kilometres away.*

- *The payphone coin box often filled up, and emptying by Telstra took time.*

The application was accepted on the grounds that a significant proportion of residents were not adequately serviced by existing arrangements. A regional DBCDE agent visited the community to start a dialogue about specific requirements. The community's preference was to locate the new telephone in a free-standing cabinet within earshot of the surrounding houses. There were concerns about personal security, so a site near a power pole was identified to provide lighting. The residents agreed and signed off to this location, which was then mapped.

As the community did not have its own store, a bulk purchase arrangement of prepaid phone cards was established with the store owner at a nearby large community, with a buffer stock of cards kept for local use.

Implementation, including the trenching and laying of an extension cable from the existing Telstra network cabinet and tower to the new location, took 12 months to complete.

Mobile phones

Service coverage for mobile phones in most remote Indigenous communities is limited. In communities where terrestrial coverage has been provided, take-up of mobile phone services often far exceeds fixed-line home phone services. Prepaid is the main account type used by Indigenous customers.

Although carriers expand mobile networks based on commercial grounds, in some instances the Australian Government provides funding to target areas of public need (typically smaller population centres and highways).

When purchasing a mobile phone, **consider**:

■ whether coverage is adequate in the area

■ cost of the equipment and the offered plans

■ monthly data download quota.

Communities can request that a mobile carrier install a base station to provide community coverage. If the carrier considers that the expected level of usage is sufficient, it will install a base station. Carriers are required to consult local communities when selecting a site for the base station within the local area. A base station's location is often a trade-off between good coverage, and low physical and visual impact. Impact on cultural sites may be a significant consideration in Indigenous communities.

Ensure that:

■ consultation meetings are arranged with the carrier and take into account the community's cultural and other needs.

Design

The community should decide if portable hand-held or vehicle-mounted units can best meet their needs.

Consider:

■ that vehicle-mounted mobile phones have a longer range and greater penetration of obstructions, but are less flexible than hand-held equipment.

Base stations

Ensure that:

■ mobile phone base station buildings and towers are securely fenced to prevent unauthorised access.

Environmental safety

A mobile phone base station transmitter emits a relatively low level of electromagnetic radiation and most of this is directed away from the antenna to provide coverage in the surrounding area.

Ensure that:

■ communities are briefed by the carrier on public safety arrangements.

Power supply

Base stations require electrical power from a local electricity source or solar panels and a battery. The carrier may ask the community for the provision of local mains electricity supply.

Satellite phones

Satellite phones are useful in general communications and have an important role in emergency plans and as backup safety devices for remote area travel. Some features of satellite phone networks are listed in Table B6.3.

Table B6.3: Satellite phone network features

Satellite phone network	Network type	Mobile/portable	Data rate (with accessories)	Other features
Globalstar	Low earth orbiting	Portable hand-held	9.8 kbps	Telephone models with dual satellite/ terrestrial mobile GSM capability (cross reference)
Iridium	Low earth orbiting	Portable hand-held	2.4 kbps	Magnetic bonnet mount external antenna kit (option)
Optus MobileSat	Geo-stationary	Vehicle mounted 12–24 volts	2.4 kbps	Transportable ('laptop') telephone models also available

GSM = Global System for Mobile Communications; kbps = kilobits per second

Each of the low earth orbiting satellite networks uses its own system of satellites, which are continuously moving overhead. The satellite phone antenna is designed to provide reasonable 'all-round' reception/transmission when fully extended.

The geo-stationary satellite networks use a single satellite that orbits at the same rate as the earth rotates. It appears in a fixed direction from any given position on the earth (that is, over the equator and in the northern Australian sky).

Consider:

■ the antenna for vehicle-mounted satellite phones must provide all-round reception and transmission, as vehicle orientation will vary

■ a higher gain directional antenna for fixed-location satellite phones can be used and some laptop-style satellite phones have a panel antenna that must be oriented towards the satellite to optimise performance.

Lifeline, emergency and essential service communications

There are requirements for adequate communications coverage for emergency and essential services between a community and its service towns. Satellite phones are required where terrestrial mobile phone or mobile radio coverage is not continuous.

Ensure that:

■ mobile communications requirements for emergency and essential services are identified.

Consider:

■ the use of positioning devices incorporating satellite communications, such as emergency position-indicating radio beacons, personal locator beacons or satellite tracking devices as safety equipment — some of these devices use global positioning system (GPS) data received from satellites and they all transmit to the monitoring satellite, so they must be used in the open and be clear of obstructions.

Mobile radio

Mobile radio provides two-way communication over relatively short distances up to a radius of a few tens of kilometres (high-frequency radio may cover much greater distances). Mobile radio networks are generally private. Vehicle-mounted or hand-held radios communicate with each other and with a fixed base station. Characteristics of the different types of mobile radio are given in Table B6.4. Repeater stations can extend the geographic range of the network.

Table B6.4: Characteristics of mobile radio technologies

	High frequency (HF)	Very high frequency (VHF)	Ultra high frequency (UHF)	
			Vehicle or fixed	Hand-held
Equipment size	Large	Intermediate/ compact	Compact	
Range	Long	Intermediate	Short (line of sight)	Very short
Ability to penetrate buildings	Not applicable	Variable	Variable (may be improved by signal reflection)	
Ability to penetrate vegetation	High	Intermediate	Low	
Terrain tolerance	High	Intermediate	Low	
Speech quality/ noise levels	Variable	Intermediate to good	Good	

Licensing

Mobile radio transmitters require an operating licence, while receivers do not. Some equipment operates under a class licence. The equipment supplier and user do not need to apply for a specific licence to operate a service and there are no licence fees. When shared among many users, interference and congestion may occur.

Other radio communications equipment, systems and services require a licence, which involves application to ACMA and the payment of a fee to authorise operation of specific transmitting equipment at specific locations and using particular frequencies. A segment of the spectrum is allocated for exclusive use by a user without interference by other users.

Ensure that:

■   a licence application is made, if required.

Range required for radio units

The required operating range and the availability of suitable radio frequency spectrums determine which radio technology to use (UHF, VHF or HF).

Ensure that:

■ the coverage area meets activity requirements; these might range from the local area (up to 10 kilometres in radius from the community), to mid-range (10–50 kilometres) to long-range (above 50 kilometres)

■ the preferred transceiver site location for fixed radios takes into account the topography of the coverage area — where possible, choose high points.

Mobile and portable equipment

Ensure that:

■ requirements are defined for mobile and portable equipment.

Base stations

Base station transceiver equipment is compact and may be located in a special room or in a general office area. Associated equipment includes a microphone, loudspeaker, antenna system and power supply.

Consider:

■ locating the user terminal, microphone and loudspeaker in a special area to prevent disturbance, or providing the operator with a headset.

Repeaters

Repeaters are automatic unstaffed transceivers, located at high points in the terrain in order to receive signals from mobile and portable radios within the operating area, and retransmit signals over a wider area than is possible from individual mobile units. Repeater masts are visible from a long distance and from all directions. Locations are commonly some distance from the community and require vehicle access roads, equipment housing and sources of electrical power.

Antenna mast height for base stations and repeaters is typically a three-way compromise between technical effectiveness, cultural and visual impact, and cost.

Ensure that:

■ landowners and community members are consulted at an early stage in the design and location of repeaters and masts

■ there is access for installation and maintenance, and equipment huts, site security and power sources (including battery or other backup) are provided.

Batteries

Most mobile radio equipment requires battery power as the primary source or as a backup to the mains supply. Battery charger models that allow the transceiver plus battery to be left in the switched-on charging mode at all times are the best option.

Ensure that:

■ batteries have sufficient capacity for the base station to operate if the primary electrical power fails

■ battery chargers and spare battery stocks are available.

Consider:

■ placing repeater equipment at a site that already houses radio equipment and transmission towers; negotiation with landholders and the use of existing facilities can be a cost-effective way to provide the new facilities.

Operation and maintenance

Ensure that:

■ regular preventive battery maintenance occurs, as battery loss is a major cause of equipment and service failure

■ equipment is maintained by the system owner and licence holder in accordance with licence conditions

■ operational procedures are well defined and documented

■ all users undergo regular refresher training in the effective use of radios (including procedures for emergency situations)

■ education about economical and disciplined use is provided to avoid congestion, particularly in emergencies.

Computer networks

The primary components of computing network infrastructure are local area networks (LANs) and wide area networks (WANs).

A LAN consists of:

■ servers, local cabling or wireless interconnection

■ networking devices, such as routers, switches and modems

■ workstation devices, such as personal computers and printers.

A WAN includes all external connections (that is, those linking the LAN to other public or private networks, such as a corporate central office and the internet).

Connection to the internet is a key part of any effective community public access. A range of technical options may be available, including:

■ asymmetric digital subscriber line (ADSL) via telephone cables if the local exchange connection with the 'outside world' has sufficiently large capacity

■ local connection via wireless using mobile phone technology, but this requires large and expensive capacity.

Government funding may be available to subsidise the cost of connecting community-based computers and networks to the Internet.

The size and capacity of the LAN will largely be determined by the required number and location of computers. The speed for the WAN will be determined by the volume of traffic between the LAN and the external network(s) (see Tables B6.5 and B6.6).

Table B6.5: Local area network (LAN) technologies

Transmission technique or service	Typical data transmission rates	Maximum transmission distance from customer telephone or computer to central equipment	Special characteristics
Wi-Fi	Up to 20 Mbps	50–100 metres with clear line of sight, or greater with directional antenna	Transmission speeds and distances depend strongly on antenna characteristics and obstructions
Unshielded twisted pair (UTP)	100 Mbps	90 metres	Similar to conventional telephone cabling but optimised for data communications
Conventional (voice grade) telephone cabling	Up to 56 kbps (modem only)	About 10 kilometres — modem speed for data transmission reduces with increasing distance	Modem speed is subject to the quality of the cable between the computer and the exchange, and the number of intermediate cable joins

kbps = kilobits per second; Mbps = megabits per second

Table B6.6: Wide area network (WAN) technologies

Transmission technique or service	Typical data transmission rates (towards customer)	Maximum transmission distance from customer location to network connection point	Special characteristics (including limitations)
2-way satellite	Up to 1 Mbps	Unlimited	Signal travelling from the earth to satellite and back results in a delay that may be noticeable
High-capacity (microwave) radio concentrator (HCRC)	Up to 19.2 kbps (ie dial-up only)	Customer equipment is connected to HCRC network equipment using conventional telephone cabling: about 10 kilometres	A widespread means of network connection for fixed phones and low data-rate services in communities in very remote areas; the microwave tower must be close to the community
Asymmetrical digital subscriber line (ADSL)	Up to 1.5 Mbps (best case, 8 Mbps)	Depends on wire diameter and quality, but typically 4 kilometres from exchange equipment	Only available from selected exchanges; delivered to customer premises on conventional telephone cabling
ADSL2+	Above 1.5 Mbps (eg 12 Mbps at 2.5 kilometres from network equipment; best case, 24 Mbps)	Depends on wire diameter and quality but typically 3 kilometres from exchange equipment	Only available from selected exchanges; delivered to customer premises on conventional telephone cabling
Optical fibre cable	Limited only by connecting equipment		Primary means of providing very high capacity linking between network nodes. Typically not available in very remote areas
3G mobile phone network	Approaching ADSL data rates (best case, 7 Mbps)		Limited areas of coverage Data rates are affected by terrain as with voice services, but effects are more exaggerated

kbps = kilobits per second; Mbps = megabits per second

Ensure that:

- requirements are defined, including:
    - number and location of computers and computing applications
    - estimated level of user activity
    - volumes of download and upload information
- internet download volumes are managed — over-quota use is expensive.

Consider:

- formal (telemedicine, teleconferencing) and informal (browsing, entertainment) use of facilities when estimating information volumes.

Design

Location of equipment

Ensure that:

- the location for satellite WAN has a clear line of sight and the dish is oriented appropriately
- Wi-Fi-equipped computers can communicate with a central wireless access point; this is affected by distance and obstructions, particularly metal surfaces in the transmission path
- community members are consulted about the training and education required for use of public access computing facilities.

Consider:

- providing separate locations or access times for men and women
- privacy requirements when introducing or relocating computers
- experimenting with different positions within the room to improve the connection data rate of a Wi-Fi-connected computer.

Protection of equipment

Ensure that:

- appropriate security is provided for buildings that house computer equipment (for example, lockable doors, secure windows)
- there is provision for regular backup (and preferably off-site storage) of essential computer data.

Consider:

- using a generator-compatible uninterruptible power supply (UPS), as computer equipment is susceptible to power outages and over-voltage spikes resulting from lightning strikes or irregular loading of the mains system.

Trade-off: complexity and ease of maintenance

Consider:

■ using relatively simple computer hardware and software if local technical support within the community is limited.

Operation and maintenance

Ensure that:

■ there are people in the community resourced to supervise the facilities and to mentor others

■ locally stored spare equipment is available together with repair and replacement contracts, and a schedule of regular visits for maintenance

■ appropriate 'responsible use' measures are implemented to prevent downloading of undesirable material — this is required by legislation in some locations (such as *Northern Territory National Emergency Response Act 2007* (Cwlth)

■ regular backup of essential data forms part of the operational plan.

Consider:

■ developing appropriately paced training programs for community members early in the planning process.

Charging for services

Community public access internet facilities are rarely self-funding, because high operating costs are usually more than people can afford.

Consider:

■ charging a nominal fee to encourage responsible use of public access facilities.

Broadcast radio and television

Radio and television services in remote Indigenous communities are provided by a combination of wide area and local transmission arrangements. Free-to-air and Pay TV options are available; Pay TV may be combined with 2-way phone and internet access.

Wide area satellite broadcast arrangements

Free-to-air broadcast content for remote area customers is delivered (as at 2009) from the Optus C1 satellite 'Aurora' platform Australia-wide.

The Aurora broadcasts — the Remote Area Broadcast Services (RABS) — are encoded in digital format and include 13 free-to-air television services and many free-to-air radio services.

Broadcast licences for content providers are allocated on a regional basis. The signal coding is arranged so that decoding for a given location only provides access to a subset of the total number of services.

Local area arrangements within the community

Although many communities have receiving and retransmission facilities, only a subset of these can provide local broadcasts.

Centralised receiving facilities

Remote communities are typically equipped with centralised satellite receiving facilities to receive and decode the RABS transmissions. These comprise a dish antenna and an integrated receiver decoder (IRD) set-top box.

Ensure that:

■ an 'Aurora ready' certified receiver package (including the dish and cabling as well as the electronic equipment and smart card) is purchased — others are unsuitable for receiving RABS services.

Retransmission equipment

Transmitting equipment located with a satellite receiver retransmits television and radio services in analog format at low power within communities. As these signals are not encoded, normal analog television and frequency modulation (FM) radio antennae and receivers can be used for reception.

Most RABS communities can now retransmit five television channels (Australian Broadcasting Corporation, or ABC; Special Broadcasting Service, or SBS; two commercial channels; National Indigenous Television, or NITV) and two radio services (ABC and their regional Indigenous media service).

Local production and broadcast facilities

Local audio and video studio recording and production facilities include switching equipment to select either the incoming satellite service or the locally produced content for broadcast to the community.

Some communities also have facilities to transmit local content via their regional Indigenous media organisation over a landline to the Central Australian Aboriginal Media Association (CAAMA) for general broadcast on the Imparja satellite service.

Equipment housing

Consider:

■ room space, rack space and power requirements

■ furniture and low noise room furnishings for studios, if the capacity to produce and transmit local programs is required.

Licensing

Apparatus licences and community broadcasting licences are issued by the regulator, ACMA.

Ensure that:

■ community-based retransmission equipment has an apparatus licence — one for each channel transmitted

■ community-based broadcasting services have community broadcasting licences — only communities with this licence receive funding under the Indigenous Broadcasting Program.

Antenna arrangements

Broadcast antennas and masts need to be located at a high point with clear line of sight across the community.

Consider:

■ co-locating the antenna with antennae for other community radio equipment

■ whether a high-gain receiving antenna is required if the line of sight to community houses is blocked.

Power backup

Consider:

■ appropriate electrical power backup for equipment, as broadcast services are generally regarded as 24-hour services.

Implementation

Installation is normally carried out by the equipment provider.

Maintenance

Ensure that:

■ arrangements are made for rapid maintenance responses to equipment failure — in most cases this will be provided by the regional Indigenous media organisation under contract.

Managing and maintaining services

There are two broad approaches to equipment repair: 'on-site repair' and 'return to base'. For remote areas, the cost of a service technician travelling to the customer location is the most expensive system of maintenance and is time consuming. Alternatively, the return to base approach returns faulty equipment to a regional service location for repair and uses spare equipment in local storage to replace the equipment quickly. Replacement is done by trained (semi-skilled) local people, under the supervision of a central maintenance depot.

Remote access facilities can enable a skilled maintenance worker at a distant location to:

■ connect to the telephone or computer system using a computer terminal

■ identify the problem

■ direct a local semi-skilled person to take corrective action.

This reduces maintenance time and costs.

Ensure that:

■ there is a sufficient level of security for remote access

■ batteries, solar panels and other items with a limited service life

- receive preventive maintenance according to the manufacturer's recommendation (taking into account local climate, environmental and operating conditions)

- receive maintenance according to the steps: 'clean, service, test and replace unserviceable equipment, then test again'.

Useful terms

ACCC	Australian Competition and Consumer Commission
ACIF	Australian Communications Industry Forum
ACMA	The Australian Communications and Media Authority, the regulator for broadcasting, the internet, radio communications and telecommunications.
ADSL	asymmetric digital subscriber line
Availability	The availability of a service is the amount of time it or a piece of equipment is fully operational compared with the total time. It is expressed as a percentage and gives a measure of the reliability or 'up time' of the service.
Bottleneck services	Services that are constrained by pricing or other factors, making their cost to customers high, and inhibiting economic growth.
Carrier	A telecommunications carrier licensed by ACMA.
Community phone	Phones provided solely for Indigenous communities, and intended primarily for use by community members.
Customer Service Guarantee (CSG)	A regulatory obligation that requires a telecommunications carrier to provide basic services of a certain quality and rectify faults within specified timeframes. If the carrier does not comply with the CSG, they can be penalised, and customers can claim compensation.
Australian Government Department of Broadband, Communications and the Digital Economy (DBCDE)	Responsible for administering the telecommunications legislation Australia-wide.
HF	high frequency
IEC	International Electrotechnical Commission
kbps	kilobits per second
Local area network (LAN)	A computer network and associated technologies that provide connection within a relatively small area, such as a building or group of buildings; in the case of an Indigenous community — within the confines of the community itself.
Mains electrical cabling	Cabling that carries a dangerous voltage and is subject to special protective design and safety rules.
Mbps	megabits per second
Mobile (radio) transceiver	A vehicle-mounted two-way radio.

Network termination point	The boundary between a telecommunications carrier's infrastructure and the customer's infrastructure — usually a small box on the external wall of the customer's premises.
PIN	personal identification number
Portable (radio) transceiver	A hand-held two-way radio.
Public payphone	Phones provided throughout Australia for use by the general public, where calls are charged and paid for at the time of calling. To be eligible for a public payphone, a community needs to have 50 or more permanent residents.
RABS	Remote Area Broadcast Services
Radio base station	The fixed part of a radio or mobile phone network with which individual mobile or portable transceivers or mobile phones communicate directly.
Telecommunications cabling	Cabling that carries a low voltage signal and does not pose a danger to people. Such cabling must be separated from mains electrical cabling for safety reasons.
Tie circuits or tie lines	Direct telephone circuits between locations that do not connect via the public telephone network.
UHF	ultra high frequency
Universal Service Obligation (USO)	A legislated scheme that ensures standard telephone services and public payphone services are available to all Australians on an equitable basis.
UTP	unshielded twisted pair
VHF	very high frequency
VoIP	Voice over Internet Protocol
Wide area network (WAN)	A computer network and associated technologies that connect local area networks (LANs) together or connect individual equipment to a network over long distances.

Contacts

Enquiry	Contact
Australian Government telecommunications and computing programs	www.dbcde.gov.au/funding_and_programs
Public payphone	www.telstra.com.au/contact/payphones.htm
Payphone and Community Phone faults and repairs	Telstra Phone Freecall 180 2244
Community phone	www.dbcde.gov.au/funding_and_programs/indigenous_communications_program
'PhoneAway' and 'Country Calling Card' prepaid phone card distribution	J.Comm Distributors Telephone (07) 3264 4090
Radiocommunications (mobile radio) licensing	www.acma.gov.au/WEB/STANDARD/pc = PC_481
Telephone/internet complaints	Telecommunications Industry Ombudsman www.tio.com.au
General telecommunications enquiries	The Centre for Appropriate Technology www.icat.org.au

Further reading

ABS (Australian Bureau of Statistics) (2006). *Community Housing and Infrastructure Needs Survey 2006, Housing and Infrastructure in Aboriginal and Torres Strait Islander Communities,* Cat. No. 4710.0, ABS, Canberra.

ACMA (Australian Communications and Media Authority) (2008). *Public Phone Services in Indigenous Communities: ACMA Communications Report 2006–07*, ACMA, Canberra.

ACMA (Australian Communications and Media Authority) (2008). *Telecommunications in Remote Indigenous Communities*, ACMA, Canberra.

ACMA (Australian Communications and Media Authority) (2008). *Cabling Regulation*, ACMA, Canberra. www.acma.gov.au

ACMA (Australian Communications and Media Authority) (2008). *Your Rights to a Telephone Service*, ACMA, Canberra. www.acma.gov.au

ACMA (Australian Communications and Media Authority) (2008). *Customer Service Guarantee Standard 2000 (No.2)*, ACMA, Canberra. www.acma.gov.au

ACMA (Australian Communications and Media Authority) (2008). *CSG Overview*, ACMA, Canberra. www.acma.gov.au

Optus (2008). *Optus Disability Action Plan*, Optus, Macquarie Park. www.optus.com.au

Tangentyere Council Research Hub and Central Land Council (2007). *Mobile Phone Use Among Low Income Aboriginal People: A Central Australian Snapshot*, Tangentyere Council Research Hub and Central Land Council, Alice Springs.

Telstra (2008). *Telstra Disability Action Plan*, Telstra, Melbourne. www.telstra.com.au