



THE NGAANYATJARRA LANDS TELECOMMUNICATIONS PROJECT: A QUEST FOR BROADBAND IN THE WESTERN DESERT

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Vast regions in Australia still have limited access to adequate telecommunications. With the rollout of the National Broadband Network underway, remote Indigenous Australia risks being left out, increasing its isolation and widening the ‘digital divide’.

In the past, the vast Ngaanyatjarra Lands of south-eastern Western Australia have had one of the poorest levels of telecommunications service in Australia. However, the regional shire, land council and the community media organisation have worked together with the WA Government to address this problem. This effective collaboration led to the Ngaanyatjarra Lands Telecommunications Project (NLTP): a fibre optic network connecting six remote desert communities, a broadband satellite solution to connect the remaining six outer communities and community-wide WiFi in all twelve sites. This article describes the process of creating the NLTP and some of the flow-on benefits for the region and Yarnangu (Ngaanyatjarra people).

INTRODUCTION:

A 2001 report on the state of telecommunications in the Ngaanyatjarra (Ng) Lands of WA reported:

It is extraordinary that in such a developed nation as Australia that the people of the Ngaanyatjarra Lands have such limited access to basic items as telephones. What limited numbers of desk and home telephones that are in place are mainly accessible only to non-Indigenous staff members. With few exceptions, houses occupied by Aboriginal people on the Lands are without residential telephones. ([Farr et al 2001](#), 30)

The Shire of Ngaanyatjarraku and Ng Council submission to the 2002 Estens Regional Telecommunications Inquiry made a strong case for the importance of telecommunications in remote Indigenous communities:

Telecommunications infrastructure and services in the Ngaanyatjarra Lands are grossly inadequate. The current telecommunications infrastructure and services are preventing people and organisations in the Ngaanyatjarra Lands from realising the social and economic opportunities available to them. [If not addressed...] welfare dependency will prevail and, in the longer term, increase. ([Thurtell 2002](#), 5)

When I began working as Coordinator of Ngaanyatjarra Media, the regional media and communications organisation based in Irrunytju community, in late 2001, the main Internet connection used in the region was via dial-up at less than 9.6 kbps. In some communities, including the regional centre of Warburton, there was no Internet capability. I was employed

to support local language radio broadcasting and cultural video production but quickly found that the higher priority for Yarnangu (Ngaanyatjarra people) was on getting telephones in their homes. When Ng Media started setting up codecs in community radio studios to enable live broadcast link-up to the regional radio network 5NPY, we discovered that the codecs would not work over the DRCS microwave network in the region. Also there were no spare phone lines at the exchange in most communities. With the increasing convergence of media and ICT, it became obvious that we could not develop the media program without improved telecommunications infrastructure. Ng Council and the Shire of Ngaanyatjarraku had been lobbying for improved telecommunications for some time, with several reports highlighting the issue, but little changed.

In November 2003, consultant John Thurtell (who wrote the submission to the Estens Inquiry) and I attended the Regional Communications Forum in Canberra, on behalf of Ng Council, to advocate for improved telecommunications in the region. In one session of the Forum there was debate among delegates about what speed should be defined as broadband: 256 or 512 kbps or faster. I commented that the discussion was largely irrelevant to the remote communities of the Ngaanyatjarra Lands, where there is virtually no Internet access and in many communities fax machines don't work over the existing phone lines. We were on the distant side of the 'digital divide'.

A WA government delegation at the Forum (including Sheryl Siekierka of the Department of Industry and Resources) outlined a proposal to establish state government facilities and services in the Kimberleys and Ngaanyatjarra Lands, including multi-function police facilities in the region at Warburton and Warakurna. These facilities, as well as schools and health clinics, required improved broadband communications for on-line networking and service delivery. We met to discuss working together on a joint application to establish broadband infrastructure in the Ngaanyatjarra Lands, which would meet the needs of the government service providers, community organisations and Yarnangu.

Following the forum, I distributed a Regional Telecommunications Strategy discussion paper, outlining five key elements:

1. Design and establish a broadband telecommunications network to service all Ngaanyatjarra communities
2. Build a regional Media and Communications Centre
3. Establish on-line access centres in each of the 12 communities
4. Establish a regional ICT training and technical support program
5. Develop culturally appropriate on-line content and resources.

It was a highly ambitious plan, given the history of telecommunications in the region. Since first receiving basic telephony services in the late 1980s little had changed, with all telecommunications services provided at the minimal requirements of the Universal Service Obligation (USO). However, within five years, all of these five aims had been achieved.

In April 2008, the WA Minister for Industry and Enterprise, Francis Logan, officially launched the Ngaanyatjarra Lands Telecommunications Project (NLTP), which provides broadband communications via fibre optic cables to six of the most remote Indigenous communities in Western Australia. In September 2008, Ng Media opened the regional Media and Communications Centre in Irrunytju as a hub for the twelve on-line media centres in the region. In 2010, Ng Media completed Stage 2 of the NLTP project, providing a broadband satellite service to the remaining six communities and shared WiFi network in all twelve communities.

This article provides an outline of how the NLTP project came about, including a description of communications in the region prior to the project and the impact that the broadband communications network has had for the Ngaanyatjarra Lands and people. The project was an effective collaboration of all levels of government working with community organisations and a corporate provider to develop a mutually beneficial infrastructure project. It offers a model for other remote Indigenous communities with last-mile sharing of services via WiFi, community owned and managed IT facilities, and skills development for culturally appropriate and relevant outcomes for Indigenous people.

THE NGAANYATJARRA LANDS

The Ngaanyatjarra Lands cover an area of approximately 250,000 square km in the Great Victorian and Gibson Desert region of Western Australia, adjoining the Northern Territory and South Australian borders and spanning the Shires of Ngaanyatjarraku, East Pilbara and Laverton. The unsealed Great Central Road bisects the region, linking Alice Springs (1,000 km north east of Warburton) to Kalgoorlie (900 km south west of Warburton).

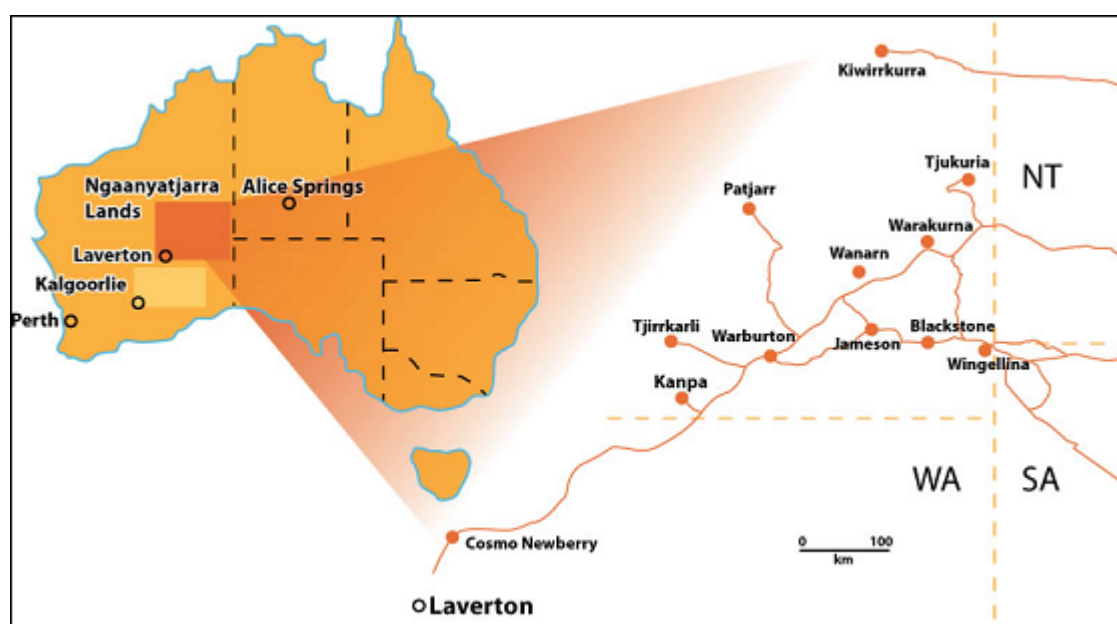


Figure 1 - Location of Ngaanyatjarra Lands

Yarnangu (Ngaanyatjarra people) have maintained a continuous association with their country and comprise the majority resident population. The regional population of approximately 2,000 people are distributed in the twelve remote Indigenous communities within the region: Warburton (the regional centre), Warakurna, Tjukurla, Wanarn, Papulankutja (Blackstone), Mantamaru (Jameson), Irrunytju (Wingellina), Kiwirrkurra, Tjirrkarli, Cosmo Newberry, Karilywara (Patjarr), Pira-Kata (Kanpa). Apart from Warburton Community, which had operated as a mission from the early 1930s, most of the communities were established as part of the ‘homeland movement’¹ since the mid 1970s. The region maintains a high level of cultural and linguistic integrity and political unity. There is limited industry in the region, with no pastoralism or large-scale mining activity.

The Ngaanyatjarra Land Council, which was established in 1981, holds some of this land as 99-year and 50-year leases and Aboriginal Reserves. In 2005 the largest native title determination in Western Australia to that time, covering an area of 188,000 square km, was handed to the Ngaanyatjarra people. The Ngaanyatjarra Region is also Australia’s largest Indigenous Protected Area. Ngaanyatjarra Media is based in Irrunytju community, 260 km east of Warburton and about 10 km from the tri-state border of WA, SA and NT.

TELECOMMUNICATIONS INFRASTRUCTURE PRIOR TO THE NLTP

The HF Radiocommunications system, which was initially set up for the Royal Flying Doctor Service (RFDS), had been used in the Ngaanyatjarra Lands since the 1940s and was the only form of telecommunications for most communities to connect to Alice Springs or Kalgoorlie up until the late 1980s². HF Radio was a popular form of communications for Yarnangu, who used it for group conversations across the lands, and to arrange cultural business and regional meetings and events. The service was free, mobile and easily accessible, with an HF radio set available day and night in a public meeting shelter in the centre of each community as well as in most community vehicles. People would even transmit music or radio programs over the network.

The HF Radphone system (which allowed an operator-assisted connection to a telephone) had only one public channel available, with calls having to be booked and all calls able to be heard across the network. Use of the emergency channel by Yarnangu led to complaints from the Royal Flying Doctor Service. In the mid 1980s other HF frequencies were made available, one to talk to Department of Aboriginal Affairs (later ATSIC), one for Pitjantjatjara Council use, and two each (RX and TX) for RFDS Alice Springs and RFDS Kalgoorlie.

In about 1987, Telstra (then Telecom Australia) set up the first telephony system in the region using a Digital Radio Concentrator System (DRCS) solar-powered microwave repeater network. A series of large towers were constructed across the lands at 40-50 km intervals enabling lines of up to 13 repeaters to extend from the exchange to communities up to 600 km away. The DRCS exchanges were designed to carry up to 127 lines of voice and low speed data traffic (maximum 9.6kbps, typically 4.8kbps) enabling fax (used for distributing public notices and written information) and basic dial-up Internet access. Wingellina, Blackstone, Jameson, Warburton, Kanpa and Tjirrkarli were connected to an exchange at Amata in the APY lands, with Warakurna, Tjukurla and Wanarn serviced by an exchange at Yulara. Cosmo Newberry was serviced from Laverton and Kiwirrkura was connected to the DRCS exchange at Papunya in the Northern Territory. ([Thurtell 2002](#), 23)

The introduction of telephones was greatly appreciated by staff and service providers in the region, who could now have private conversations without queues or time limits and competing with other users to communicate. However, the DRCS exchanges were soon stretched beyond their design capacity and had numerous issues: insufficient number of lines to meet community needs; solar powered batteries going flat after two or three overcast days; frequent breakdowns and outages; clicks and echoes causing regular dropouts; data speed barely able to handle facsimile transmissions let alone Internet, data exchange or EFTPOS equipment. By the mid-1990s the DRCS exchanges had become hopelessly overloaded and unable to meet the increasing demand. ([Thurtell 2002](#), 23)

In 1999, Telstra sought to address the congestion by: 1) extending the fibre-optic cable that extended through the APY Lands from Pipalyatjara community to the two eastern-most Ngaanyatjarra communities Irrunytju and Blackstone; and 2) Taking Warburton off the DRCS exchange and installing a Rapid Switching Stage exchange fed by an ITERRA satellite station. This did provide short term relief to the DRCS network, but as Thurtell described, the ITERRA system was “abysmal” and “outages, clicks, echoes and dropouts are still the norm, as is a data transmission speed of 2.4 kbps” making Internet access impossible (Thurtell 2002:24). The ITERRA system was intended to be a temporary solution, to be superseded by a planned extension of optic fibre cable from Blackstone to Warburton, but the extension did not occur and the satellite system was still in place until 2004.

Despite having fibre to the exchange at Irrunytju and Blackstone, the exchanges at both sites were only used for POTS³ with no capacity for ISDN or ADSL. It was not until 2002, after extensive lobbying, that Telstra installed ISDN capability in Irrunytju to enable use of the videoconferencing unit supplied to the Irrunytju School. An early test on this facility drove community demand for a public videoconferencing facility for link-ups with institutionalised family members in prison or hospital.

In late 2003, Telstra upgraded the DRCS microwave telephony network to a Higher Capacity Radio Concentrator (HCRC) Swing system under the USO, providing a more reliable and faster⁴ POTS service and a small increase in the number of lines across the region. However, exchange upgrades were not carried out to meet the community demand for additional phone lines. Several of the smaller and more remote communities rely on satellite telephony.

Following the partial privatisation of Telstra (T1) in 1997 and the T2 sale in 1999, the Australian Government rolled out several programs aimed at ensuring equitable and affordable access to modern communications technology for remote and regional Australia. These included the establishment of the Universal Service Obligation (USO) contract in 1998 and the \$352 million *Networking the Nation* (NTN) funding program from 1998-2005.

In 2000, Ng Council commissioned consultant Peter Farr and Associates to undertake a telecommunications needs audit and strategy for the region, to be used as part of a submission for Networking the Nation funding. The *Networking the Ngaanyatjarra Lands* report noted:

The remoteness of the Lands to major service centres such as Alice Springs, Kalgoorlie and Perth, the great distances between communities, the area's severely limited infrastructure, and the costs of physical movement of people and things, intensifies the need for alternative methods of service provision. ([Farr et al 2001](#), 8)

The major recommendation of the report was to extend the fibre optic network from Blackstone to other communities in the Ng Lands in order to provide a back-haul framework to support further initiatives. However this was not funded by NTN as it was not using 'innovative' technology, was too costly (estimated at \$2.63 million) and was considered to be the responsibility of an existing telecommunications provider under the USO (i.e. Telstra). Only two recommendations of the Farr report were funded – a Virtual Private Network for the region (used to network the Ng Health Service clinics via two-way satellite to the Communicare patient records database) and a UHF Radio network – while those proposals dependent on existing broadband infrastructure were not funded. As a result, the Ngaanyatjarra Lands received relatively little benefit from the NTN.

The Evaluation Report of the Networking the Nation program cited a number of respondents in remote, sparsely populated areas complaining that the "NTN's resources were insufficient to address the very large infrastructure requirements of more remote areas" ([DCITA 2005](#), 46). Several Western Australian and Northern Territory respondents expressed the view "that those who benefited least were remote Indigenous communities, where there is still a high degree of expectation and unmet demand" ([DCITA 2005](#), 60).

Lack of existing infrastructure issue also impeded the outcomes of the NTN-funded iConnect project initiated by Pitjantjatjara Yankunytjatjara (PY) Media in 2001. This project aimed at rolling out pre-paid phone services to community houses across the APY and Ngaanyatjarra Lands using pre-paid cards, eliminating the risk of billed phone services not being paid. PY Media worked with communities to coordinate the orders and facilitated the rollout of services with Telstra. Ng Media worked with PY Media to extend the project into Ng communities to address the high demand from Yarnangu for home phones. However, of the 199 requests by Ngaanyatjarra households in 2003, only 35 services were rolled out by Telstra due to lack of adequate infrastructure, including nine communities having no line availability. Telstra argued that they were not bound by the USO requirement of installation

within three months of ordering because the USO only applied to billed services, not pre-paid services.

The NTN-funded UHF radio network was installed by the Shire of Ngaanyatjarraku in early 2003, with a repeater network reaching most of the Ngaanyatjarra Lands⁵. Within weeks Yarnangu were using the UHF network day and night, as their main form of communications, mostly in language and with several discussions going at once: 'true Yarnangu radio'. Handsets were prized items, with the high demand for AAA batteries being the main issue. The UHF radio network proved a highly effective communications system for Yarnangu, enabling communications across the region via a repeater channel (as well as multiple local use channels), affordable user-friendly handsets, and emergency communications on roads in case of breakdowns or accidents.

Unfortunately the UHF repeater network lasted less than three years due to lack of operational funding for maintenance, damage to towers by camels and difficult access to towers on top of hills to maintain batteries. The issue of ongoing viability of the facilities set up under capital infrastructure programs such as NTN in remote areas is a common one, with many examples of one-off capital projects ceasing operations due to lack of ongoing operational and maintenance funding.

Prior to 2002, the only Internet access in the region was in schools, clinics and the Shire office, using expensive satellite services. In 2002-3, Telstra rolled out two-way Internet satellites (under the government-funded Extended Zones Untimed Local Calls Tender), which made a huge difference in the region, enabling affordable and reliable Internet access in communities for the first time. The subsidy covered installation and equipment costs with a reduced usage cost⁶. However, while this service met the basic needs of most users initially, the service was over-subscribed, slowing down during peak use periods, and the limitations of the two-way satellite soon became apparent. Issues included: Low download limits and high excess costs leading to large bills; services not designed to be networked, requiring a dedicated account for each computer; software not Mac compatible; signal loss in thick cloud or dust conditions; requirement of phone line to set up; asymmetrical service limiting two-way applications (e.g. videoconferencing); and excessive latency.

Local government, schools, health clinics and police had problems accessing on-line servers for records retrieval and communications due to latency issues over satellite Internet. These applications included the WA Police 'Briefcase' records access, the Communicare patient records database used by Ngaanyatjarra Health Service clinics and videoconferencing facilities for court hearings, education or tele-health. The Education Department had set up a costly broadband satellite Internet service at each school, but was unwilling to share this with other community users due to security concerns.

There was a growing need for a terrestrial broadband network in the region to avoid latency and the high cost of broadband satellite usage. A coordinated telecommunications plan was needed to ensure efficiency of cost, inter-connectivity and capacity for future growth. There were also other factors that needed to be considered in determining appropriate infrastructure and services for Yarnangu, including: low socio-economic base; affordability of services; operational and maintenance costs; scalability of infrastructure to meet future needs; mobility of Yarnangu between houses or communities; viability of smaller communities; provision of community access IT facilities, training, technical support, relevant content and resources; Internet banking access and training (with CDEP wages and Centrelink payments paid directly into bank accounts from 2004); access to videoconferencing (enabling family link-ups with those in distant institutions - prison, hospital, aged care – as well as meetings, e-health, training delivery and court hearings, reducing costly travel); cultural and social impact of introduction of more western media and values via broadband, requiring skills development to support Yarnangu communication, language and cultural maintenance, education and empowerment; on-line risks including pornography/inappropriate content,

Internet fraud, viruses & worms; low literacy and English as a second (or third, fourth or fifth) language (audio-visual and icon-based programs more effective than text-based applications).

OPTIONS FOR BROADBAND LONG HAUL

Ng Council, Shire of Ngaanyatjarraku, Ng Health Service and Ng Media devoted significant time and effort in 2002-3 exploring the options for getting broadband telecommunications into the region. The key options for long haul broadband services were:

1. **Satellite:** The benefits of satellite are: relatively inexpensive and easy to install, works in the most remote locations, and enables basic needs for email and Internet. The downside was latency, usage and excess download costs, limited regional network capability, and not suitable for higher bandwidth or symmetrical applications. Seen as a short-term solution by most stakeholders until terrestrial infrastructure could be established.
2. **Fibre Optic:** Benefits include low latency, robust infrastructure, capacity for high speed and bandwidth, relatively affordable services and ability to use as backhaul framework for other infrastructure, such as mobile telephony or extension to other sites via microwave. The only downside was the high cost of installing cable (costed in 2003 at over \$5 million to extend the fibre network 200 km from Blackstone to Warburton and up to \$15 million to extend along the Great Central Road to Wanarn, Warakurna and Docker River)⁷, requiring government funding and an external company to install and maintain a fibre-optic network.
3. **Microwave:** This had become a more realistic option, with new technology repeaters enabling higher bandwidth and longer ‘hops’ of up to 60 km (reducing the number of towers and power supplies required) and lower capital cost than fibre. While independent advice suggested this was the most cost-effective solution, a proposal by NDC costed a regional microwave network at \$6 million to reach four inner communities and an extra \$7 million to reach a further three sites, leaving five sites not linked.

Factors	Satellite	Microwave	Fibre Optic
Cost - Capital (Capex)	Low	Medium	High
Cost - Installation	Low	Medium	High
Cost - R&M	Low-Medium	Medium	Low
Cost - Usage (Opex)	Medium	Low	Low
High use/ excess download	High	Low	Low
Latency	High	Low-Medium (depends on distance)	Low
Max Speed/Bandwidth	Up to 1Mbps	Up to 12Mbps	Up to 100Mbps
Download limitations	Up to 15GB/mth	Can be unlimited, but will affect speed	Can be unlimited
Back-haul	Satellite	Via fibre optic from Blackstone &/or Docker River	Fibre optic

Factors	Satellite	Microwave	Fibre Optic
Range of services	Internet, email	POTS, Internet (ADSL or equivalent)	POTS, ADSL, ISDN, BDSL, GBIP
Videoconferencing capability	No	Yes	Yes
Communities reached	All	Most likely 7-9 of 12	Most likely only 6 of 12
Telco ownership/ Competition or locally owned	Multiple providers- BigPond, Optus, Newsat, etc	Telstra or locally owned and managed	Telstra
Exchange upgrade requirements	No, direct-to-building service	Yes, may need new node facilities	Yes, to enable new services to be added
Portability	Can be easily relocated	Can be relocated but towers are fixed	No, fixed underground cable to exchange
Scalability	Can easily upgrade services or add more dishes	Would need to replace repeater equipment, all else scalable	Already has high capacity to meet future needs
Ability for regional wide area network (WAN)	Not easily	Yes, for communities linked	Yes, but through Telstra product

Table 1 - Comparison of the primary broadband options

The regional consensus was that a terrestrial communications network – via fibre optic cable or microwave transmission – was the best option in terms of ongoing cost to the communities, reducing latency issues and enabling videoconferencing and future applications. However, both solutions required significant up-front infrastructure funding. Based on the costing received, broadband microwave transmission network was the most cost-effective solution to deliver the range of services and applications and most likely to gain funding.

Ng Media proposed that Ngaanyatjarra Council seek funding for a Ngaanyatjarra-owned and managed microwave broadband data delivery network, with savings by building on the Ngaanyatjarra-owned UHF network infrastructure (which was in planning phase with eleven towers to be built across the Lands). By owning the infrastructure, intra-regional communications would be effectively free (apart from maintenance costs), with payment only for use of the Telstra fibre backhaul ([Featherstone 2003](#)).

However, Ngaanyatjarra Council and Shire of Ngaanyatjarraku representatives were not enthusiastic about owning and managing telecommunications infrastructure, preferring to have any infrastructure installed and managed by Telstra, the existing telecommunications service provider for the region. The Shire of Ngaanyatjarraku even offered to contribute some funds to Telstra towards infrastructure costs. But Telstra Countrywide were not prepared to cover any capital costs of installing terrestrial broadband infrastructure (fibre optic or microwave) in the Lands as the returns from the region were not commercially viable, noting that their service obligation was fulfilled by the provision of two-way satellite services. Telstra suggested that Ngaanyatjarra Council seek government funding.

With applications closed for the NTN program, no alternative broadband infrastructure program available, and DCITA⁸ advice that they would not fund infrastructure projects that were considered the responsibility of the telecommunications service provider, Ng Council was in a quandary. It was with this conundrum in our minds that John Thurtell and I headed to the Regional Communications Forum in Canberra in October 2003.

THE NLTP PROJECT BEGINS

Following the Regional Communications Forum, Ng Council, the Shire of Ngaanyatjarraku, Ng Media and the WA Government all began to work together on a joint submission to deliver broadband in the region. The WA Department of Industry and Resources (DOIR) applied for the Coordinated Communications Infrastructure Fund through DCITA. The bid was successful for the maximum \$2 million funding, which was matched by WA Government funding of \$2 million, with Shire of Ngaanyatjarraku also contributing \$750K to extend the outcomes of the project. The total project budget was \$5.8 million, comprising the \$4.75 million funding and anticipated expenditure on telecommunications services by stakeholders over 4 years of \$1.05 million.

Beginning in May 2004, the Ngaanyatjarra Lands Telecommunications Project (NLTP) was a four-year collaborative project with the aim of providing enhanced broadband telecommunications services to the twelve Ngaanyatjarra communities and improving government service delivery to the region. The NLTP Steering Committee comprised representatives from the key WA Government departments (Industry and Resources (DoIR), Treasury and Finance (DTF), Western Australian Police Service (WAPS), Education and Training (DET), the Attorney General, Justice (DoJ), Local Government & Regional Development (DLGRD) and Community Development (DCD) as well as regional stakeholders Shire of Ngaanyatjarraku, Ng Council and Ng Health Service.

The project was managed by Anson Cheng, a former telecommunications engineer employed by DoIR, who did an outstanding job in coordinating the project, communicating with all stakeholders throughout the process and seeking to gain the maximum possible ‘bang for the buck’ from the project. The telecommunications needs of each stakeholder were identified, along with the likely expenditure on services to help make up the case for the negotiation. \$4 million was allocated for the infrastructure and 5-year service contract, with the remaining \$750K budgeted for additional services and project management costs.

A Request for Proposals was put out to the market in early 2005. The contract was non-technology specific with the requirement that the solution be capable of handling “email and Internet, videoconferencing and voice communications and high-speed high volume business applications” (Cheng 2005, Slide 20). The respondents had to propose a sound infrastructure solution (with demonstration of ‘proof of concept, commitment to ‘buy-local’ for goods or services where possible, and a proven track record to deliver projects of this scale on time and budget. The successful contractor would be responsible for design, construction, commissioning, operating and maintaining the network infrastructure, with ownership of the infrastructure and equipment granted at the end of the 5-year contract period (Cheng 2005, Slide 19). Several respondents argued that the \$4 million being offered was insufficient for the scale of the project being tendered, with some proposed budgets significantly above this amount. Three preferred tenderers were selected and asked to submit a full submission. After a lengthy assessment and nearly a year spent in a complex negotiation process, Telstra eventually won the contract in June 2006.

While most bids proposed satellite or microwave solutions to the twelve disparate communities, Telstra proposed a fibre optic solution for the six larger central communities, with a broadband ITERRA digital satellite solution for the other six communities as a potential future project (requiring additional funds). Telstra proposed an upgrade to the

existing optic fibre routes between Wingellina and Blackstone, and adding 385 kilometres of new 12-fibre cable from Blackstone via Jameson west to a T-junction at Bajic Corner, extending south-west to Warburton and north-east to Warakurna, with a 15km link to Wanarn, as per the diagram below ([Cheng 2006](#), 4)

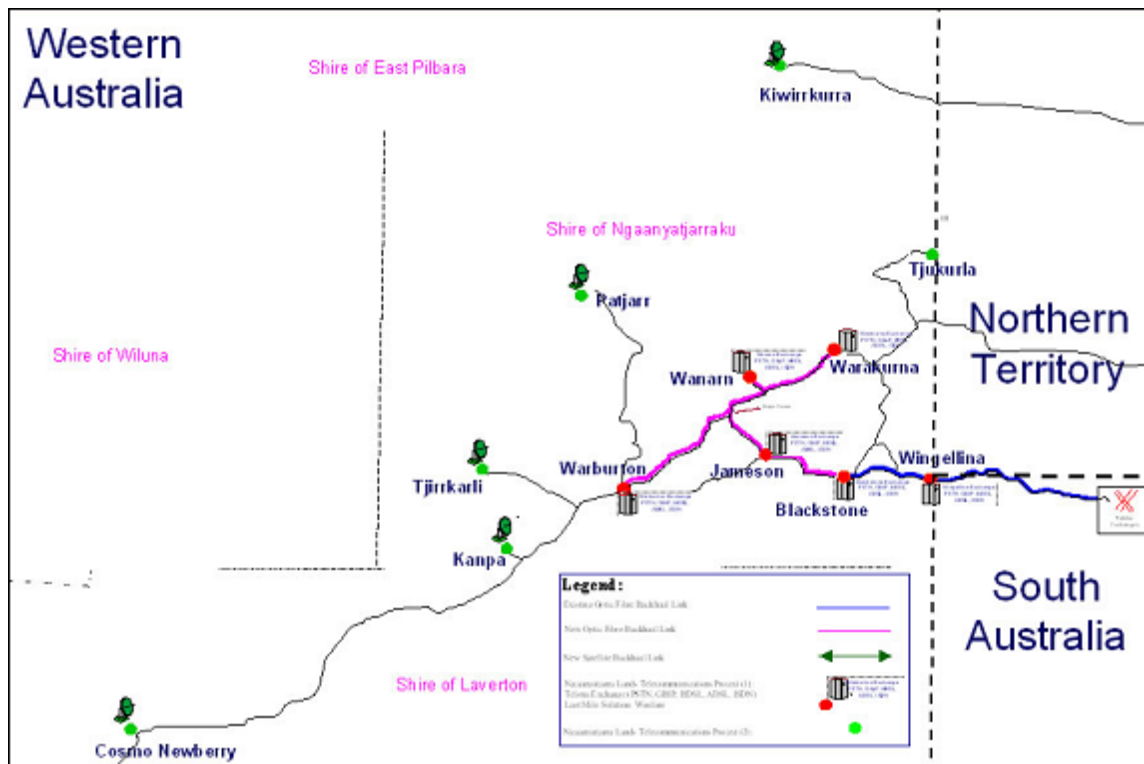


Figure 2 - Map showing fibre path of optic rollout (in pink) to six communities, with satellite solution for remaining six communities under NLTP Stage 2. (Figure courtesy of Anson Cheng, WA Government)

The transmission paths were to be provided on multiple 622 Mbps Asynchronous Transfer Mode Systems, as an extension of the existing Core SDH Network ([Cheng 2006](#), 4). The solution included exchange upgrades in each community to enable STS, ADSL, BDSL, ISDN and VPN at each site, and an increase in phone line availability. The last mile would make use of existing copper cable distribution for DSL and ISDN services, with the schools and police facilities to have fibre optic cable run to enable high-speed GBIP services (2Mbps).

Telstra's proposal for the fibre optic solution was costed at \$6.4 million, to be made up of the \$4 million funding and \$2.4 million Telstra capital investment, to be recouped in broadband usage contracts over five years. The Project Evaluation Committee determined that the benefits of having a terrestrial fibre solution to only six communities, which could be built on for future solutions (mobile telephony, extension via microwave to more remote sites etc), was best value-for-money and would address many of the issues of latency and higher capacity application needs such as videoconferencing. To ensure Telstra's return on investment, each anchor tenant in the project was required to sign a 5-year contract for services with Telstra.

Ngaanyatjarra Council, Ngaanyatjarra Health Service and the Shire of Ngaanyatjaraku negotiated in their contract to share the cost of a single dedicated 512K BDSL service in each of the six communities (a total of \$54K or \$18K each per annum). This included an Internet plan with unlimited download for each of the six sites, which ensured a fixed annual cost in the event of increased demand and growth in use for five years. The negotiated contract also allowed distribution and on-selling of the service to enable shared community and agency access and cost-splitting.

While the fibre solution was ideal, there were still six communities from the original project brief that would not benefit. Some of these smaller and more remote communities had already had some health and education services withdrawn, making access to effective communications and on-line service delivery critical to their ongoing viability. The Steering Committee agreed that these sites should also receive improved broadband communications, allocating \$350K for NLTP Stage 2 to provide a centralised satellite broadband solution with WiFi last-mile delivery in these six sites.

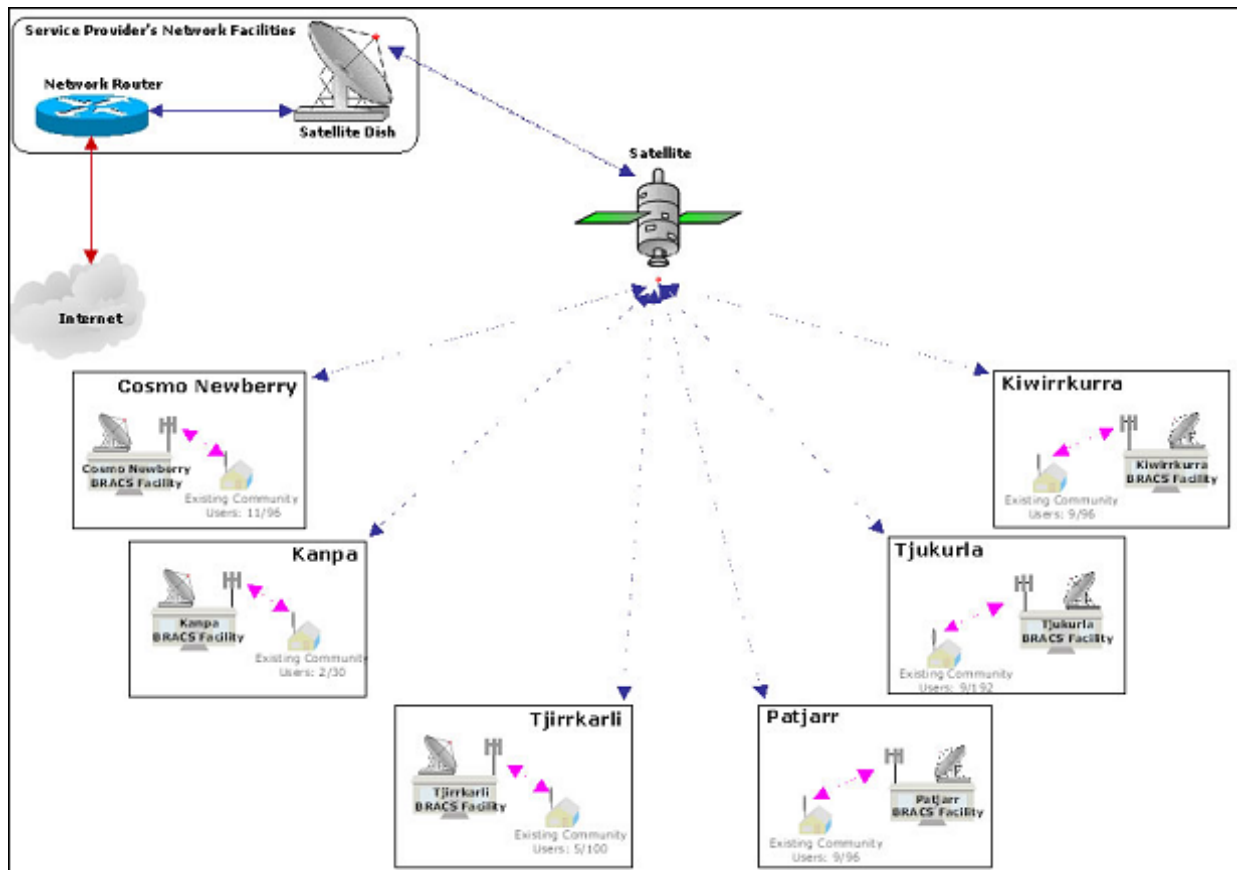


Figure 3 - NLTP Stage 2 showing broadband satellite delivery to six outlying communities.
(adapted from diagram by Anson Cheng, WA Government)

The Ngaanyatjarra Lands Telecommunications Project took another three years to complete, including gaining Aboriginal Lands Trust and Shire approval, archaeological assessment, flora and fauna impact studies, land use clearances by traditional owners, and scheduling of the cable-laying contractor. Initially the exchanges were upgraded at Irrunytju and Blackstone and tested in 2006 as a ‘proof of concept’. The other four exchanges required significant upgrades or replacement to accommodate the new equipment.

The rollout of cable was the most expedient part of the process, with a convoy of earthmoving equipment covering up to 30km a day clearing the vegetation along the route, digging the trench, laying the cable, covering the trench and planting yellow marker posts every 200m or so. The only holdup was heavy rain leading to the whole rig being relocated to another region for a couple of weeks until the mud dried out. Finally the fibre network was ‘lit up’ and tested in late 2007, and was officially launched in Warakurna community in April 2008.



Figure 4 - The fibre optic cable being laid near Blackstone community.
(Photo: Daniel Featherstone/ Ngaanyatjarra Media)

Initially Telstra planned to only install the high-end stakeholder solutions – GBIP, BDSL or ISDN – with ADSL only provided if at least 30 households/offices signed up for services. We argued that the project was funded to provide affordable and accessible broadband services to communities, not just government agencies, and Telstra finally relented and installed ADSL equipment. There was substantial take-up of ADSL services by community facilities, service providers and staff households, but none initially by Yarnangu households. Despite concerns by Telstra over competition, there have been no other suppliers delivering ADSL or telephony services in the region via Telstra’s fibre network to date.

The first stage of NLTP resulted in a significant improvement in broadband access and uptake in those communities. However, we still had to provide broadband services to the remaining six communities and install a last-mile delivery system for sharing the services in all twelve sites.

CONSIDERATIONS FOR LAST MILE DELIVERY

While the negotiated single BDSL service significantly reduced the investment required of the three regional stakeholders in the NLTP project (down from \$180K to \$54K pa), it raised the issue of how to effectively share this service. It was initially planned that the BDSL would be shared with community and roving users, however this raised a number of issues around access, security, cost recovery from various users, last mile delivery systems, network management (prioritisation of usage by user or application, virus scanning, content filtering, network and traffic segregation, identifying excessive usage etc), R&M and technical support, and redundancy systems.

To avoid these issues, the Shire decided that the BDSL service should be connected to the clinic in the six sites with all other users to get separate ADSL services. However the BDSL did not meet the Ng Health Service needs, replacing it with a higher-speed ADSL service to enable videoconferencing, with the BDSL service relocated to the RIBS transmission facility for sharing via wireless last-mile delivery.

Ngaanyatjarra Council, the Shire of Ngaanyatjarraku and Ng Health Service agreed to pay a third each of the BDSL service for the 5-year period (to 2011), effectively subsidising all other community users on the network and simplifying the issue of cost-recovery from multiple

users. With most community facilities having already purchased ADSL accounts, the focus shifted to the needs of community users and roving service providers and last-mile delivery options.

Ng Media, with the help of telecommunications consultancy firm Civitium, was tasked with determining appropriate technology options for the last-mile delivery of services, with the key considerations being: cost (capital, labour, R&M, usage), range, speed, reliability and accessibility. The basic aim was to provide free community access to the shared broadband service for Yarnangu, community agencies (office, store, CDEP, art centre, media centre etc) and visiting service providers via a reliable last-mile service. With most community agencies in the inner six communities signed up to ADSL services, the focus shifted more to the needs of community users and the remaining six communities. While wireless delivery was the easiest and most affordable, there were a variety of wireless options to consider.

In response to concerns about the reliability of wireless by some regional stakeholders, Ng Media assessed the option of running cabling from the central site to key community facilities. While this enabled a reliable and secure network link, it would require extensive trenching, conduit, and cable and network infrastructure. Cat 5e cabling was ruled out as it was only suitable for short distances up to 100m and had a limited life of 6-10 years. Fibre optic cable would have to be used, requiring expensive conversion equipment at each end, making this solution too costly. We also considered the new technology of Ethernet over Power (EoP), using the community powerlines for distributing broadband. While this was proven technology within a household, there were few examples of its successful application over a larger network with separate lines, and concerns of risks due to faulty wiring. This effectively ruled out terrestrial last-mile distribution, leading us back to wireless technologies. The central TV/radio broadcast tower and RIBS facility in each community provided line of sight over less than 1km to most households, making it the obvious facility for wireless broadband distribution via an access point with omni-directional antenna (or cluster of 60° or 120° antennae).

We considered Motorola Canopy wireless equipment, which is a robust, secure and proven technology for commercial and remote use. However, the system uses a proprietary encryption system requiring a subscriber module for each user, making the equipment cost too high for our budget (a point to multi-point setup with 1 Access Point, 3 subscriber modules, mounting brackets and a cluster management module cost nearly \$10,000 before installation). The subscriber system also prevented shared “hot spot” access for community or roving users, which was considered more important than a secure network

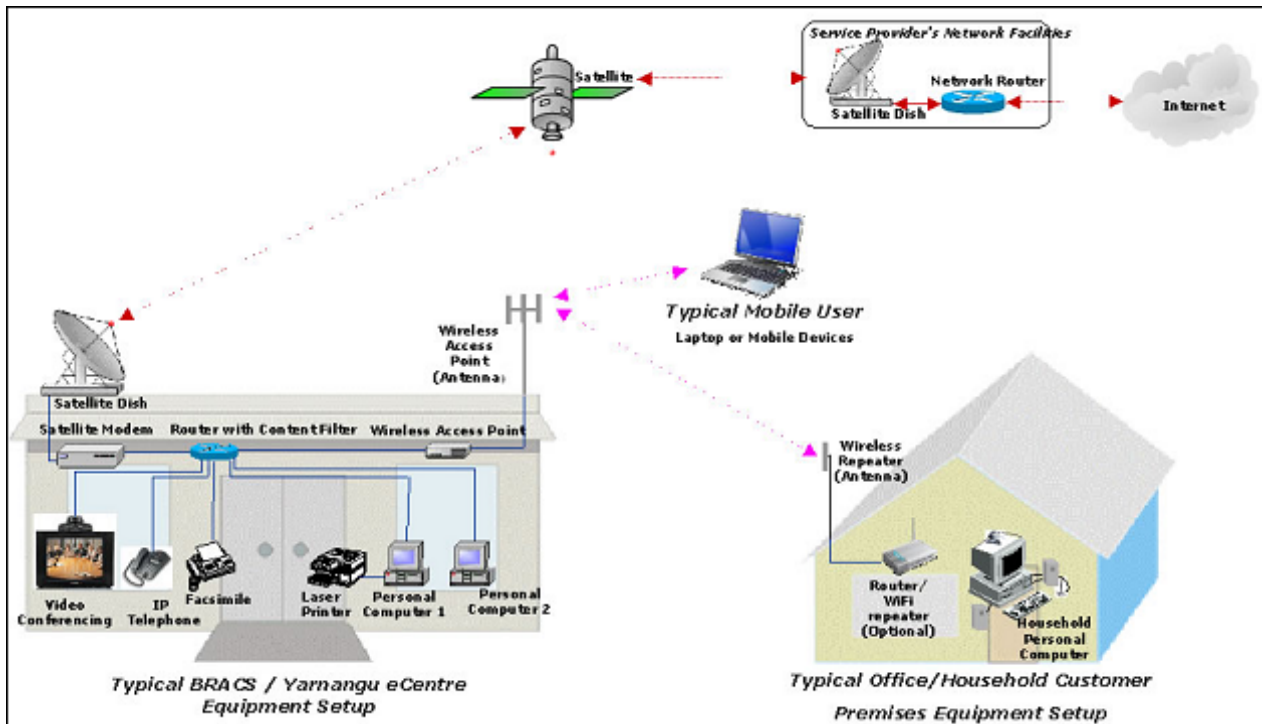


Figure 5 - Last mile wireless distribution (adapted from diagram by Anson Cheng, WA Government).

Following an assessment of other wireless technologies (including the new WiMax), it was concluded that commercial grade WiFi was the most appropriate and cost-effective solution, enabling access by any number of potential subscribers (although speed would suffer as contention increased). WiFi would enable ‘hot spot’ access by any user with standard laptop or mobile device with wireless reception capability anywhere in the community. While a single transmitter from the broadcast tower was preferred, WiFi Mesh technology could extend the coverage area in case of signal loss due to distance, trees or other barriers, by strategically positioning repeater access points on power poles around the community. Domestic WiFi routers could be set up as local repeaters to boost the signal inside buildings where signal strength was low. A password could be added to limit access, but it was considered counter-productive to have tighter security and management measures (e.g. ‘Hot Spot’ management software) in the initial stages.

NLTP STAGE 2

With the last-mile delivery system worked out, the NLTP Stage 2 project began in 2008 to build on the NLTP, to provide satellite broadband and last-mile WiFi transmission to the 6 communities that did not receive the fibre optic solution. \$350K funding was granted directly to Ngaanyatjarra Council to provide improved broadband satellite equipment and services to the six remaining communities that did not receive the fibre optic rollout-Kiwirrkurra, Cosmo Newberry, Kanpa, Patjarr, Tjukurla, and Tjirrkarli. Ng Media was contracted to install the broadband satellite dishes and shared WiFi equipment, and manage the operational costs, including payment of satellite costs and ongoing repair and maintenance, for a three year period (to mid 2011). The WiFi service would enable access to the broadband service by community facilities, Yarnangu and support staff when travelling in the region. However, the relocation of BDSL services took nearly a year due to Telstra outsourcing all new line connections and trenching to contractors who rarely visit the Lands.

Ng Media’s Technical Services Unit installed and commissioned the 1.8 m satellite dishes in the six communities in late 2008. After a comparison of satellite services available, a Newsat service with speed of 1024/256 kbps and 10GB download cap per month was selected. The

service was initially networked within the Media building or community office where installed prior to WiFi rollout.

The rollout of WiFi equipment to all twelve communities was carried out by early 2010⁹. Ng Media had extended the scope of the WiFi rollout with funding from DLGRD for a Communications Access project, providing WiFi in the other six sites in conjunction with the replacement of broadcast towers in seven communities. All WiFi units were set up with a common password to enable authorised users with easy access in any community. The wireless access points (APs) were collocated on the broadcast tower with the TV & radio retransmission and BDSL router in the RIBS broadcast facility, allowing coordinated technical support. Ng Media installed a Cisco router at each site to enable remote monitoring and technical support, and to redirect DNS web traffic to an external content filtering service (Open DNS). For cultural sensitivity reasons, filtering was critical prior to sharing the Internet service.

Despite using 3x120° antennae to ensure strong signals, the coverage was still not as uniform as hoped, with significant signal loss through trees and metal-clad buildings. We boosted the signal with two-way amplifiers, with possible need for additional WiFi Mesh units in larger communities to reach ‘shadow’ areas.

YARNANGU OWNERSHIP, ACCESS AND SKILLS

Once the NLTP was underway, Ng Media sought to establish community access facilities, training and on-line content, and help build Yarnangu awareness of the potential benefits and pitfalls of this technology. We needed a proof of concept for relevant and appropriate use of broadband and ICTs.

Telecentres WA, a WA Government initiative to provide community access computers to regional centres, provided the first-in solution. Telecentres WA received NTN funding to build robust telecentres, or MITEs, for Indigenous communities and encouraged Ng communities to apply. Ng Media successfully applied for a MITE in Wingellina, which included eight access computers, server and videoconferencing equipment, with an ongoing operational fund of \$20K pa. The 20-tonne 3-room transportable building, which was set up in early 2004, provided a test site for community access to computers, Internet and self-paced training. Internet was provided via a shared two-way satellite service (with 1GB download limit) and a single 128kbps ISDN line connected for video conferencing.



Figure 6 - Irrunytju Telecentre (MITE)- typical daily community use. (Photo: Daniel Featherstone/ Ngaanyatjarra Media)

Ng Media employed an IT trainer to work in the telecentre and develop non-accredited training models, locally produced media content and resources, and source relevant on-line content. The telecentre proved to be very popular with hundreds of users each week listening to music, looking at local photos and videos, using Internet banking, playing online games and using the Ara Irititja archive computer. This provided a model for Internet access and skills development to extend other communities. Telecentres WA followed up with telecentres for Warburton, Tjuntjuntjara (to the south) and Warakurna. Ng Media looked for an alternative low-cost model to provide community access computers in the other communities to help prepare Yarnangu for the arrival of broadband.

In 2006-7, Ng Media delivered basic IT training to over 530 people and basic technical training to 60 people in 16 communities in the region under the Future Skilling Outback (FSO) WA project. Initially we set out to establish an e-centre in each community as a discreet space where Yarnangu could access and use computers for their own purposes. Through the NLTP, WA Government departments donated 69 second-hand PC computers, enabling us to install up to four PCs at each site in addition to a Macintosh computer for media applications. The computers were installed in the telecentres in three communities or in the community media centre (RIBS) in most others. Participants helped to clean, paint and furnish their media e-centres using donated materials, building local ownership and participation. We networked the computers to a server sharing access to content – music, photos, videos – and Internet where available (via satellite prior to NLTP).

Local Yarnangu trainer/supervisors were trained and employed to assist with training, manage the facility and provide ongoing support for community users between visits by roving trainers (a male/female team for gender-based training), with a Help-desk phone set up for support. Initially we focussed on engagement using off-line media applications such as music, digital photography, digital art, games, Ara Irititja regional archive project, video editing and music recording music, with many people getting involved and beginning to use computers regularly. From there we progressed to text-based and on-line applications including Internet banking and web searching. We developed relevant training resources, content and environment to ensure ownership, participation and sustainability beyond the life of the project.



Figure 7 - IT training and computer use at Jameson Community media centre. (Photo: Ngaanyatjarra Media)

We continued to build on this with other IT training programs under the Backing Indigenous Ability (2007-2009) and current Indigenous Communications Program, resulting in IT usage becoming a common part of community life. Ngaanyatjarra Media has also set up a regional website (www.ngurra.org) to provide a public face for communities from a Yarnangu perspective. As part of regional IT training, participants have contributed stories and photos to the regional portal website and uploaded local music recordings to iTunes store and video productions onto Youtube. Yarnangu are increasingly capable of participating in work that requires some computer usage, including working in the community office, store, school, clinic, media centre, and arts centre.

In order to further support Yarnangu uptake of communications technology Ng Media set up the regional Ngaanyatjarra Media & Communications Centre in Irrunytju (completed 2008). This facility includes the upgraded and highly popular Irrunytju telecentre and provided a regional hub for the network of community on-line media centres and telecentres by coordinating training, broadcasting, resource production, local language media and on-line content, archiving and technical support.

The ongoing community use of telecentres and e-centres have led to a majority of community members now having some level of IT skills and awareness of on-line services.

According to research undertaken in the region by Dr Inge Kral (2010), the continued access to the new generation media centres provide a Lifespan learning environment for young people to engage, develop skills, create media and increasingly take on professional and leadership roles in their communities. In Ngaanyatjarra communities, Kral has observed young people in communities progressing from basic IT experimentation with Mac-based iLife software to video editing, DVD production, music recording and CD production using GarageBand software. She notes that “competence is gained informally through observation, peer learning, trial and error, practice and interactions with non-Indigenous mentors.” (Kral 2010, 6) Kral refers to international research that locates the ‘digital bedroom’ as the most vibrant digital learning environment for youth, describing the community media centres as “the *communal* ‘digital bedroom’. With up to 20 people sharing a house and limited access to

IT facilities or connectivity at home, the media e-centres provide facilities, relative privacy and tools for media production and storage.

However, the reliance on these facilities is shifting as access to telecommunications and mobile technologies improves. With the introduction of WiFi in Ng communities, there have been numerous reports of Yarnangu buying personal computers or laptops for use at home and connecting via WiFi with friends in other communities and outside the Lands using Facebook or email. Along with mobile telephony, this is creating new opportunities for skills development and creative expression, as Kral describes

As mobile phones, digital cameras, MP3 players, Touch iPods and even laptop computers have become affordable, this has placed smaller mobile technologies in the hands of Indigenous people, predominantly young people under 25. The control of technology has shifted away from institutional locations or non-Indigenous authorities and young people are now initiating productive activity in ways that were previously unimaginable. Digital technology is firmly part of people's everyday lives. ([Kral 2010](#), 6)

In the article 'Beyond Public Access? Reconsidering Broadband for Remote Indigenous Communities', [Rennie et al 2010](#) consider the relative benefits of community access on-line centres compared with shared wireless services for individual household access. They argue that the assumption of shared community access facilities (e.g. telecentres) as the ideal model for remote communities needs to be tested:

Although some level of community ownership and organisation is desirable and necessary in the remote context, the question is whether this should always or generally provide the exclusive paradigm for access and use. Innovative models, such as that emerging in Wingellina and through the PY Ku network, demonstrate that the 'public' or community role might be better targeted at infrastructure and networks that reduce economic and technological barriers, leaving a space for individual and household use. ([Rennie et al 2010](#), 65)

They conclude that while current community use occurs "within the public domain of the community access centre", that the "inverse scenario, where connectivity is widely and publicly available, and use occurs according to the individual's need and location, may be key to overcoming the digital divide in the long term." ([Rennie et al 2010](#), 66)

With this project, Ng Media has sought to provide equitable access to communication tools for Yarnangu, free of the external restrictions over location, time and conditions of use.

INITIAL BENEFITS OF BROADBAND

The NLTP is already making a difference in the region, enabling service providers to use increasingly sophisticated applications. Primary school children are using on-line applications such as Google Earth and Virtual Classroom; Police and health staff can access records throughout the region; videoconferencing facilities are being used for court hearings (reducing unnecessary travel), tele-health, training, meetings and family link-ups; government service delivery is more efficient; communities can access up-to-date accounting and on-line banking information; roving staff can connect to WiFi for email and Skype communications in any community at any time; community generators and water filtration systems can be monitored remotely.

As costs of services come down and higher bandwidth services become available, enabling delivery of high-speed traffic over a regional network, the potential applications for media sharing, tele-visual communications will open up: mobile VoIP telephony, IP videoconferencing, regional IPTV networks using digital TV sets to connect to local

broadcasting via WiFi, on-line Ara Irititja archive database, community uploading of videos for ICTV or Indigitube (remote media streaming website).

THE PROS AND CONS OF MOBILE TELEPHONY

Another key outcome of the establishment of fibre optic backhaul infrastructure has been the capacity to provide mobile telephony. Following lobbying from the Shire of Ngaanyatjarraku, the WA Government secured additional funding to establish a Telstra Next G mobile tower in Warburton in 2008, with the possibility of others to come in Warakurna and Blackstone. The Shire considered mobile communications to be a positive and necessary development in the region to support travellers, government and regional service providers and Yarnangu to have access to telephony in the community.

Mobile telephony is increasingly being seen as the most appropriate mode of telephony in remote Indigenous communities. Due to shared households and lifestyle (mobile populations, living outside of houses and homelands outside of communities), mobile telephony is a more appropriate form of telephony access. In remote communities where mobile telephony has been installed, mobile phones are tending to be more popular than fixed services in remote areas. Even in sites where there are no services there is high uptake of mobile phones for use as a media storage tool and for use when in coverage areas. Mobile phones are being used as a media creation/distribution tool, sharing content via Bluetooth, and will increasingly be used for the next generation of media makers.



Figure 8 - Mobile phones are being used to play and share videos even in communities without mobile coverage (Photo: Daniel Featherstone/ Ngaanyatjarra Media)

However, there are significant issues relating to mobile telephony for remote Indigenous communities, including: high cost of usage, especially for pre-paid services, making it significantly more expensive than fixed line services ([Dyson and Brady 2010](#))¹⁰; access to inappropriate content; and unsolicited calling and marketing. In Warburton community, the high cost of usage is a major issue, with many people owning mobile phones but unable to afford recharge cards. As [Dyson and Brady 2010](#) contend, if mobile telephony is to be the primary service for communities, measures need to be taken to make it affordable such as including it under the USO with an untimed capped call rate of \$0.30.

Further, mobile telephony should not be seen as a replacement to alternative technologies such as UHF radio, which provides free communal communications and greater coverage areas, or community WiFi, enabling free home Internet and VoIP access via shared broadband services.

CONCLUSION: THE NEED FOR A TRULY NATIONAL BROADBAND NETWORK

While only just beginning to realise its potential usage and applications, the NLTP provides an example of the significance of providing broadband to remote Indigenous communities. The sustainability of remote communities could well depend on the availability of high quality communications infrastructure to enable access to tele-health, remote education, videoconferencing, online government services and eco-tourism and other economic opportunities. Increasingly, new infrastructure such as water treatment, generators, telephone exchanges, server equipment and broadcasting facilities are being managed remotely, reducing the cost of contractors having to visit communities to carry out servicing.

In 2009, the Rudd Labor government introduced the \$43 billion National Broadband Network (NBN), which aims to build a super-fast national fibre-to-the-premises network. Despite Telstra's initial reluctance to cooperate with the project, on 20 June 2010, the Government announced an \$11 billion deal with Telstra to lease its fixed network access infrastructure for the NBN and to move Telstra's fixed line customers to NBN fibre, closing down the copper access network. On 29 November 2010, the Gillard government passed two key bills allowing the structural separation of Telstra to prepare the way for the NBN to proceed. The rhetoric is that the NBN will reduce the current digital divide for regional and remote areas. The NBN is now aiming to connect 93% of all Australian premises with fibre-based services (at 100Mbps) and the remaining 7% with next generation wireless and satellite technologies (at least 12Mbps) (www.nbnco.com.au), but no further detail is given on which technology (wireless or satellite) will be provided to remote and very remote communities. What is clear, however, is that a project such as the NLTP is highly unlikely to occur in other remote regions under the NBN.

With the establishment of a new company (no longer Telstra) to provide last-resort USO telephony services, there is an opportunity to ensure that remote areas are appropriately serviced under the NBN, with consideration of maximum latency measures on backhaul infrastructure, fixed-rate mobile telephony as a primary telephony service, inclusion of pre-paid services, capacity for high-bandwidth applications (such as IPTV and videoconferencing) over regional networks, and provision of shared access community broadband services (e.g. using WiFi). Just as the NLTP sought to provide scaled services to its remaining six communities, the NBN should also provide improved services to all Australians regardless of remoteness.

This case study shows the value of broadband access in helping to break down the tyranny of distance through the use of new communications technologies (e.g. videoconferencing, VoIP, social networking) and enabling access to on-line service delivery, training applications, remote support and broader networks. Beyond the provision of reliable backhaul infrastructure, it describes an appropriate last-mile delivery model using WiFi to enable cost-effective community access and ensure indigenous people are not subject to a localised 'digital divide'. Provision of community access e-centres and recurrent IT training and technical support and on-line content development programs have been shown to reduce the 'digital divide' for Indigenous people and provide significant outcomes in terms of education, employment, engagement and empowerment.

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All network diagrams courtesy of WA Government (created by NLTP Project Manager Anson Cheng). Photographs and Ngaanyatjarra Lands map courtesy of Ngaanyatjarra Media. Permission has been granted for use of all images.

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ACRONYMS:

5NPY	5 Ngaanyatjarra Pitjantjatjara Yankunytjatjara (satellite radio network)
ADSL	Asymmetric Digital Subscriber Line
AP	Access Point
APY	Anangu Pitjantjatjara Yankunytjatjara (Lands)
ATM	Automated Teller Machine
ATSIC	Aboriginal and Torres Strait Islander Commission
BDSL	Business Digital Subscriber Loop (Telstra product)
BIA	Backing Indigenous Ability
BRAC	Broadcasting for Remote Aboriginal Communities Scheme
S	
CB	Citizens' Band
CCIF	Coordinated Communications Infrastructure Fund
CDA	Community Development Adviser
DBCD	Department of Broadband, Communications and the Digital Economy
E	
DCD	Department of Community Development

DCITA	Department of Communications, Information Technology and the Arts
DET	Department of Education and Training (WA Government)
DLGR D	Department of Local Government and Regional Development (WA Government, now Department of Regional Development and Lands)
DNS	Domain Name System
DoIR	Department of Industry and Resources (WA Government)
DoJ	Department of Justice (WA Government)
DRCS	Digital Radio Concentrator System
DTF	Department of Treasury and Finance
EoP	Ethernet over Power
FSO	Future Skilling Outback WA (IT Training and Technical Support)
GB	Gigabyte
GBIP	Government Broadband Internet Protocol Services
HCRC	High Capacity Radio Concentrator (microwave telephony system)
HF	High Frequency (Radio)
ICT	Information and Communications Technology
ISDN	Integrated Services Digital Network
IP	Internet Protocol
IPTV	Internet Protocol Television
IRCA	Indigenous Remote Communications Association
IRDP	Indigenous Regional Development Program (WA Government program)
ISP	Internet Service Provider
kbps	Kilobits per second
LAN	Local Area Network
Mbps	Megabits per second
MITE	Modular Interactive Technology Environment
MFPP	Multi-Function Police Facility
NBN	National Broadband Network
NDC	Network Design and Construction (a subsidiary of Telstra)
Next G	Next Generation (Telstra mobile telecommunications product, based on 3G)
Ng	Ngaanyatjarra
NLTP	Ngaanyatjarra Lands Telecommunications Project
NOIE	National Office of Information Economy
NT	Northern Territory
NTN	Networking the Nation (the Commonwealth Government's Regional Telecommunications Infrastructure Fund)
ODN	Outback Digital Network (NTN-funded project)
PC	Personal Computer
POTS	Plain Old Telephone Service
PY Media	Pitjantjatjara Yankunytjatjara Media
RFDS	Royal Flying Doctor Service

RIBS	Remote Indigenous Broadcasting Service
RIMO	Remote Indigenous Media Organisation
RX	Receive
SA	South Australia
STS	Standard Telephone Services
TAPRI C	Telecommunications Action Plan for Remote Indigenous Communities
TX	Transmit
UHF	Ultra High Frequency (Radio)
USO	Universal Service Obligation
VET	Vocational Education and Training
VoIP	Voice over Information Protocol
VPN	Virtual Private Network
WA	Western Australia
WAPS	Western Australian Police Service
WiFi	Wireless Fidelity
WiMax	Worldwide Interoperability for Microwave Access

ENDNOTES:

- 1 The 'homeland movement' was a Federal government program initiated by the Whitlam government in the early 1970s to enable people to return from centralised missions and reserves to their traditional homelands and outstations
- 2 Warburton Community had a Telstra Radio telephone until the late 1980s.
- 3 POTS: Plain old telephone service
- 4 Increased to a maximum 19.2 kbps, from the 9.6 kbps of DRCS.
- 5 A similar NTN-funded UHF network was also installed in the APY Lands in 2004.
- 6 Bigpond EZ Services ranged from a basic service for \$25 p.m. to the Business-grade service, which was \$60 p.m. with an advertised maximum speed of 400/64 kbps and a 1GB download limit.
- 7 Costing provided by Telstra Countrywide, June 2003, based on a cost analysis done in 2000.
- 8 The then federal Department of Communications, Information Technology and the Arts
- 9 The contractors recommended Ligowave WiFi access points, which they had installed in mining sites and, while relatively inexpensive, were robust and reliable.

- 10 Recent research by [Dyson and Brady](#) (2010), undertaken in Cape York community Hopevale where a mobile tower was installed in 2008, indicated that 55% of residents owned or shared a mobile phone. The average monthly usage costs were \$378, compared with about \$47.95 for a fixed line phone for the same number of calls, or about \$45 using the public payphone.

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