# COS10025 Technology in an Indigenous Context Semester 2 2022

# Innovation Concept

**Project Title:** COS10025 Technology in an Indigenous Project Innovation Concept

**Project Team:** Group 3

**Year:** 2022

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# Part A

## Project Overview

The town of Bamaga, Cape York suffers from outdated telecommunications, hindering the community's access to the internet and associated benefits such as communication, education, and wellbeing.

Although there is early establishment in telecommunications in Bamaga, Cape York, phone and internet providers are neglecting this small and isolated town, resulting in reduced coverage for townspeople. Service providers such as Telstra need to improve their telecommunications availability, speed, affordability and reliability to allow Bamaga citizens to access the benefits of modern technology.

The overall goal and scope of this project is to propose an affordable yet effective way to solve Bamaga's limited telecommunication coverage. In the past, providing modern telecommunication services to remote locations has proven to be too costly for governments, leaving isolated towns such as Bamaga well behind in modern technology, masking them from the benefits that come from this. Consequently, a low cost solution must be proposed to attract interest of key stakeholders in funding the project. The solution must also appeal to the end user: the citizens of Bamaga, to ensure it is the best solution and improves the community's quality of life as much as possible.

## Project Requirements

Many actions, processes, and conditions/criteria were taken place to achieve the outcome of this project.

Our group had to take into consideration the client needs and stakeholders. These needs are crucial to determining the best solution for the townspeople of Bamaga. Our needs were taken directly from the telecommunication guiding principles; they are as followed:

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

These principles are also what our group’s criteria was based on, as well as the points that were established in each of our literature reviews.

Each of our literature reviews in Assignment 1, looked at peer-reviewed sources about Indigenous Communities and their current digital literacy, internet, and telecommunication infrastructures. Based on these articles and surveys, we were able to determine the best way to move forward with our own solutions.

Part B includes our brainstormed solutions, related to the above criteria (being the telecommunication guiding principles), and our learning issues identified during the first few weeks of this unit. Design specifications allows us to think about the many hardware and software requirements needed, identifying what is in our group's scope and whether it can achieve our overall goal. Weighing up the benefits and constraints of our solutions help determine which is the best infrastructure to continue with.

# Part B

## Design Idea/Concept #1 (Disaster Awareness) - James

The learning issue that I am addressing is Disaster Awareness, which is under the Health and Safety telecommunication guiding principle. Disaster Awareness relates to the lack of immediate access to alerts about weather, natural disasters, and health concerns such as pandemics (COVID-19). These alerts can be critical if missed, considering the location of the community.

The design idea I have brainstormed to combat this learning issue is the implementation of CubeSat's, wireless satellite connectivity in the township of Bamaga, Cape York.

CubeSat's are small nano satellites that orbit Earth in Low Earth Orbit (LEO), that contain many instruments, allowing for different purposes (NASA, 2018). Some of these purposes can be research related, but more often now, they are being used as a means of telecommunication solutions.

The reason for opting for a wireless solution instead of a wired, ground based solution, is purely for the fact of my learning issue. A ground-based solution would be completely insufficient in the case of a weather/natural disaster. For example, say if a flood were to happen in the township, ground based services would be majorly affected, through damages and impact forces of the flood. Whereas, if a wireless CubeSat approach was to take place, it is most definitely away from the town, and can still be accessed during these disaster events.

Also, more companies are taking on this approach which makes it an obvious choice for the town to become an adopter as well. Other use cases include SpaceX's Starlink satellites which provide global satellite connectivity across the world. T-Mobile has recently partnered with SpaceX to implement their own technology for their carrier customers starting from next year (SpaceX and T-Mobile, 2022)

Apple have announced during their recent September event that they are implementing a new satellite connectivity feature on the iPhone 14's, for anyone that is in the forest and wilderness, and need to contact emergency services (Apple, 2022).

NBN even have their own satellite service, Sky Muster and Sky Muster Plus, which are already available for Australians to use!

Design Specifications, such as hardware and software requirements, is something I needed to consider when brainstorming this solution. Satellite Connectivity would be considered as a Level 3 – Core Layer in the three-level hierarchical model. The core layer is described as the backbone of the network, managing the transport between the uplink to the end user. This will be the physical hardware included in this solution. Factors such as cost will need to be taken into consideration as although satellites are initially expensive, as explained below

under affordability, the average wage of Bamaga is high, allowing for expenses like these to be tailored for.

For the Bamaga townspeople to be able to access this satellite-based network, Level 1 – Access Layer will need to be taken into consideration. A solution for this would need to be a satellite dish, that is installed at the user's home, and they can set this up through an app, allowing them to connect to CubeSat's in space, for a wireless connection!

There are many benefits to the use of CubeSat's as a telecommunications solution. Directly approaching the telecommunication guiding principles, instead of a "hard-coded" section for benefits and constraints, I will instead explain both in each principle to get a grasp of every point, for every category!

In relation to access and equity, satellite connectivity can be used in both household facilities and centralised public facilities. Although, in a more public setting with many people around, delays will be experienced. However, as the township is rural it works better, especially in a household setting, where people would be anyway in the event of an emergency. All households in the community will be able to easily access telephone services, information about emergency alerts, and can be provided to everyone, regardless of experience with technology and special needs, such as the elderly and disabled.

Health and Safety, being my specific principle I am tackling, this brainstormed solution greatly benefits as it is ultimately the best solution during emergency situations. CubeSat's are pretty much the only way to go to cover all bases, as they will be nowhere near the town if any emergency situations were to occur.

In terms of appropriateness, the solution of CubeSat's is one that can drastically improve Bamaga's current infrastructure. Not only are satellites robust and having a long-expected lifetime, but they can also be accessible for the entire location of the township and have large capacity requirements. The only downside to satellites is the environmental impact, not on Earth per say, but more contributing to Space Debris and Space Junk, an already massive problem. However, having smaller satellites like a CubeSat, allows for less space to be taken up, and less of a problem occurring in terms of crashing into other Space Debris in Low Earth Orbit.

Affordability is a massive factor when considering telecommunication services in an Indigenous Australian township. The unfortunate thing about satellite connectivity is that it does not come cheap. This is something I have thought about. Bamaga has a median weekly household income of $1,630, only $113 under the national average. Rent is also significantly low in Bamaga at $120 a week, compared to Australia's $375 per week. Factoring all this into consideration, the extra costs will not make a stark difference to the expenditure of the average Bamaga household.

Environmental Health relates to if there are any public health and safety concerns. When talking about CubeSat there are absolutely no concerns relating to the health of humans, such

as any emissions, pollution, and radiation. Regarding impacts in Low Earth Orbit, deploying extra CubeSat's, adds to the already ever-growing Space Debris, or space junk, conundrum.

Regarding sustainable livelihoods, maintenance is a key factor when considering telecommunication solutions and whether it would need to be maintained a lot. Luckily for satellite connectivity through CubeSat's, exceptionally minimal maintenance is required. There are experts that deal with these types of things, which all fall under the branch of Space Situational Awareness, which describes the monitoring and tracking of orbital space-based objects. Companies like Saber Astronautics are *pioneers* in this field.

In relation to other design constraints, due to the nature of wireless connectivity, especially through satellites, latency is common. However, in the grand scheme of things, this is not a delay that is a matter of life and death. It is all known that cable is the fastest solution, but that cannot be implemented when thinking about solutions for Bamaga.

## Design Idea/Concept #2 (Health) - Shreeya

### Learning Issue

The learning issue addressed by the design concept in this section is the lack of access to an efficient healthcare system in the Bamaga community. While there is a hospital for the community people, there is a gap in the technology used by the hospitals to keep track of patient records, which in the past has led to a fatality.

Telehealth is not a service available readily to the people and access to emergency healthcare services is also compromised as a result of connectivity issues in the area. The use of telecommunication to facilitate professional development among medical staff working in the hospital is also not feasible due to the unstable network status in the region.

In order to improve the situation of access to healthcare in Bamaga, it is necessary that we address the root cause of the problem, that is, the lack of a stable mobile network and broadband connection in the area.

### Design Concept

Due to the distance of rural areas from metropolitan regions, there is limited scope for optical fibre connections. A possible design idea is to establish a fixed wireless network throughout the city.

Fixed wireless connection allows a location to connect to the internet using radio waves. It dismisses the use of optic fibre and satellites and offers efficient bandwidth and low latency at an affordable cost to the general public, the fixed wireless connection is appropriate for the town of Bamaga.

Installing the connection to a fixed wireless network is also relatively simpler which further enhances its feasibility for a remote region.

## Design Outline

Fixed wireless connection is a point-to-point network that uses antennas near the premises that have a clear line of sight to NBN internet towers. According to the official NBN website(https://www.telcoantennas.com.au/nbn-coverage-map/), there is no NBN tower present that includes Bamaga in its connectivity ranges, it is important that a tower be installed in the Northern Peninsular area to facilitate connectivity in the region.

Fixed Wireless Access (FWA) connects access points in a target premise like a home, school, business or hospital to an internet gateway through antennas mounted on high regions like rooftops to ensure a clear line of sight to allow high-speed data transmission from the router to the internet. The router in the premises will be connected to the antenna. This connection is usually done by the service providers appropriately without damaging the property and ensuring that an efficient connection is set up.

The main logic behind a fixed wireless connection is like that of a mobile hotspot where you turn on the hotspot and a connection is established with the mobile network base to create a Wi-Fi tethering. In fixed wireless, we have a fixed router whose only responsibility is to allow Wi-Fi connectivity. In some cases, network operators use Customer Premise Equipment (CPE) which is used to receive the signal and a separate router to transmit Wi-Fi while some use a two-in-one device.

When the antenna receives the signal, the router transmits Wi-Fi signals. In a large building like a hospital, one CPE can be used to receive the signals and ethernet cables from the CPE can be connected to routers on various building levels providing Wi-Fi services throughout the building.

FWA was also used in one of the first 5G network cases thus emphasising its importance for the future of digital connectivity.

## Design Specifications

Once an NBN tower is installed with Bamaga in its connectivity range, which will be a part of the Core layer, all premises interested in connecting to a fixed wireless network must be installed with an antenna, a router or a CPE, CAT5 cable and a surge protector.

An external high-gain antenna, usually smaller than a satellite disc, is mounted at one of the highest points of the building to allow for a clear line of sight of the tower. Classified as under the access layer, this allows for the best connectivity possible in the location. The router is connected to the antenna via a CAT5 cable. The router is responsible for receiving signals from the antenna and transmitting it to other devices to ensure connectivity.

A surge protector protects the hardware equipment in use from sudden power surges during data transmission.

## Design Benefits

For a town like Bamaga, it is necessary that the solution implemented caters to all parts of the community from inhabitants to schools, hospitals and local businesses. In terms of access to a stable internet connection over a small area like a house or a larger area like a hospital, FWA is the most suitable as you can have one single router with a large area coverage or multiple routers on various floors giving high-speed internet access across the building. The latter solution is especially important in the case of hospitals where it is crucial that every department has adequate connectivity to be updated on every patient record.

Compared to solutions involving satellite connections, fixed access is more affordable to install in remote regions and low latency in fixed access connections gives it an upper hand over satellite connections.

FWA when used with inefficient equipment can result in low energy efficiency and waste of radio resources. However, using the correct equipment like high gain antennas for receiving signals improves radio efficiency and throughput making FWA an efficient and sustainable connectivity solution.

FWA is also much more resistant to extreme weather conditions than satellite connectivity. For example, while satellite connectivity could experience some disturbance due to cloudy weather, fixed wire access would work with no interference.

FWA usually has no data cap, that is, a limit on how much data can be transmitted by a user at a specific throughput for a specific fee, or a very high data cap that allows download speeds as high as satellite services. This also means a more reliable bandwidth for the customers to take advantage of.

## Design Constraints

Since FWA uses radio waves for data transmission, it is likely to be lossy and a little sensitive to extreme weather conditions like rain and snow. Smaller cell sizes will increase the cost of installation but will also improve the connectivity in such situations.

In order to ensure more efficient signal transmission, CPE may be required to radiate high radio frequencies. It is important that this is regulated to ensure that no serious harm is caused as a result.

It is also to be noted that the distance between the customer premise and the tower is to be 14 kilometres or less for a connection to be successfully established. If not non-traditional ways of installing a FWA connection can be used which uses a few more equipment and procedures.

# Design Idea/Concept #3 (Current Telecommunication and Affordability) - Elijah

## Learning Issue

The learning issue addressed by this design concept is the current availability and affordability of telecommunication services and how this can be improved.

## Design Concept

As a whole, the Bamaga population earn a comfortable amount of income. Currently, Bamaga citizens pay less than half the weekly rent when compared to the rest of Australia, paying a median of $120 a week compared to the Australian median of $300. (Australian Bureau of Statistics, 2021) Their median weekly household income sits at $1630. Whilst these people earn a fair wage, the cost of high-speed, modern technology in such a remote location is too high for it to be viable.

Being an isolated town in Northern Queensland, Bamaga cannot afford access to the same infrastructure that major cities in Australia can. The citizens of Bamaga have reduced access to fast and reliable broadband, which hinders their everyday lives in areas such as communication, education, and wellbeing. Currently, 4G Telstra mobile phone coverage is available in Bamaga, however this is often seen as unreliable as it is about one thousand kilometres from the closest major city, Cairns. Faster and more reliable internet should be provided to the people of Bamaga to provide them with the same opportunities as their urban counterparts in an ever-evolving technological world.

In order to solve this underlying problem, modern spaced-based telecommunication should be implemented for use in Bamaga to ultimately increase the affordability of the telecommunication services in Bamaga.

## Design Outline

Currently, Bamaga citizens access power via a 240-volt power supply. (Various Authors, 2022). The power lines are old-fashioned and outdated, and thus are subject to breakdowns causing blackouts from time to time. When these power outages occur, residents are left without access to power and thus their internet services are compromised. Additionally, residents purchase electricity through prepaid Power Cards that are available in twenty or fifty-dollar amounts; an outdated and ineffective method that reduces the availability and affordability of power and telecommunication. Telstra provides 4G mobile coverage to Bamaga but is known for providing an unreliable service to far-north Queensland, and many citizens are looking for answers to this unreliability. (Nicholls, 2022). Campaigns have been started to improve the telecommunications in the region. (Queensland Country Life, 2016)

Space-based telecommunication uses satellites to send and receive information. This is particularly useful in remote locations, where building of new infrastructure can often be overly expensive. The use of satellites to relay information negates the need for outdated and expensive earth-based alternatives. By doing so, the cost to implement broadband services to a small community such as Bamaga can be greatly reduced which will vastly improve the affordability of fast and reliable telecommunication services to the community of Bamaga. While this can greatly benefit the Bamaga community, it can also benefit other rural Australian communities much the same, highly increasing the return on investment.

## Design Specifications

Spaced-based telecommunication requires a large amount of hardware and software to be implemented. As Bamaga is a small community, industry professionals will be required to set up the new technology and teach locals how to operate and maintain the equipment.

The distribution layer is in the form of a satellite in space, to act as the catalyst to send and receive information between telecommunication devices. A satellite that is already in operation can be used in order to reduce costs. New space-based telecommunication uses large groups of satellites that work together as a system to provide fast internet access in remote locations. Making use of this solution would be most appropriate for Bamaga, as it can provide competitive prices when compared to extending existing broadband connections, which are often slower and require more to set up and maintain.

The access layer of the system will be an antenna tower. This must be established in Bamaga to receive information from the satellites and allow Bamaga locals to access high-speed internet. As Bamaga is a town of only around one thousand residents, this antenna tower wouldn’t have to be very large, and thus it would be relatively inexpensive. Townspeople will access this high speed internet using internet modems in their houses, and using their cellular devices.

## Design Benefits

Space-based telecommunication will benefit every Bamaga citizen by providing them with an inexpensive way of affording high-speed and up-to-date telecommunications. This will give all locals important access to broadband internet that will help improve their communication, education and wellbeing without being too inaccessible to lower income individuals.

Improved telecommunication will give locals better access to emergency services and telehealth, improving their wellbeing and sense of security. Being such an isolated town, Bamaga has restricted access to emergency and medical services, but improved telecommunications could be a way to solve this. It will also give students access to remote education services, to educate them on more modern topics that can help create jobs and help these students to make a living. Bamaga’s lack of tertiary education could also be solved by this, as tertiary classes can be given to students remotely.

### Design Constraints

The antenna tower will need to be maintained regularly by professionals to ensure it can stay in operation for a long time, in order to increase the value of the investment. This will create new jobs for the Bamaga locals, but they will need to be further educated about the technology required to be able to provide adequate maintenance to the tower and other technologies.

There may be some initial cost involved in implementing the modern telecommunication antenna. This cost will need to be covered by local governments and the Bamaga community.

## Design Idea/Concept #4 ( Network Management) - Nahid

### Learning Issue

This plan technique solves the learning concerns related to the current network services as well as potential upgrades.

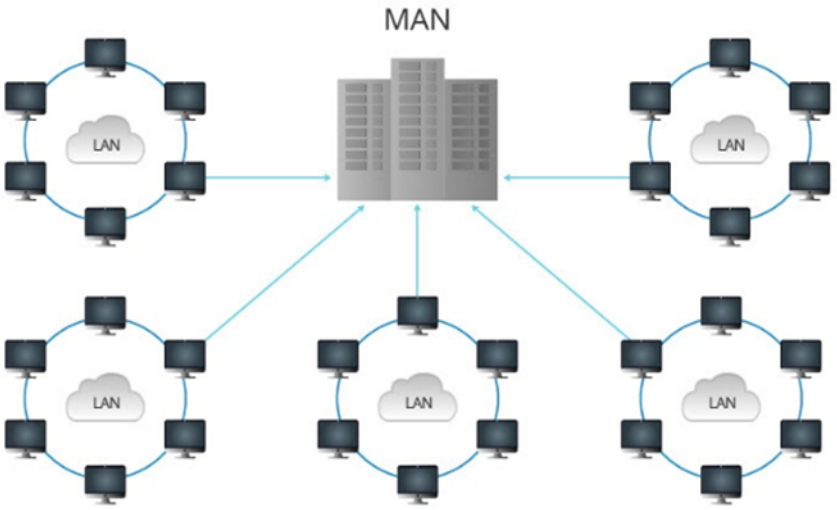
### Design Concept

Bamaga is a small community, has a struggling community with little to or no connection to the many internet services Australia provides. The highlighted learning problems will be addressed throughout this study by looking at potential solutions. The highlighted learning problems will be addressed throughout this study by looking at potential solutions. When considering new telecom solutions to improve the awful online connection in this area, there are a number of restrictions that need to be taken into account. First and foremost, access and value should be outlined for the reason that everyone deserves fast access to a basic telephone service, including the elderly and the disabled. Prosperity and security should be taken into account throughout the construction and support of the media transmission towers themselves to prevent major harm to people. This is due to the fact that broadcast communications services are crucial life preservers for any remote location and frequently play a crucial role in emergency situations. To provide emergency and vital services, a town or provincial focus needs to have satisfactory communications with its administrative satellites. Furthermore, in order to protect the land from being destroyed, it is crucial to keep the environment in mind during the project. Any media communications system, such as electromagnetic radiation, that might have an impact on public safety and wellness should be taken into account when planning and putting together services. Due to the community's extreme isolation and lack of awareness of the required maintenance, the project team must also consider appropriateness when developing a design for this project. Robustness, location, availability, expected lifetime, capacity requirements, and environmental impact are all factors that must be taken into account. Given that the networks' lack of transparency historically drove up the cost of the majority of common things, choosing the last option should be a highly sensible decision.

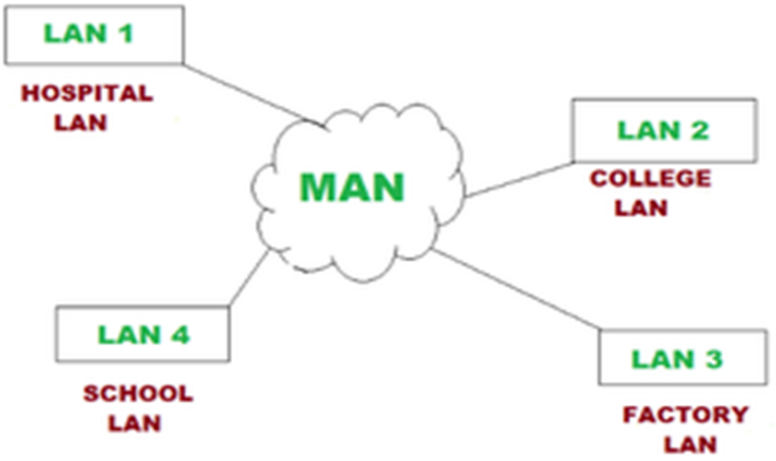
The locals of this isolated village have a very strong connection to their country, which shouldn't be jeopardised by the introduction of a reliable and powerful website. In conclusion, it is crucial to take into account feasible vocations. Due to their low population density, high cost, and limited access to alternative sources of communication and transportation, rural areas should keep up with and provide top-notch broadcast communications infrastructure.

## Design Outline

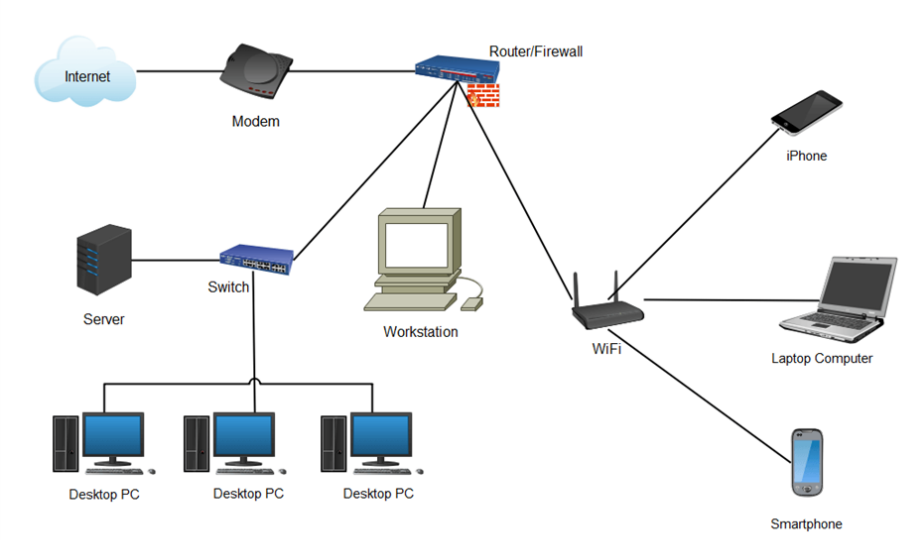
My plan is to utilise a Metropolitan Area Network (MAN) in a strategic position to provide a robust and more dependable internet connection for this community. Given that the networks' lack of transparency historically drove up the cost of the majority of common things, choosing the last option should be a highly sensible decision.nity by allowing it to connect through its local area network (LAN) to the MAN using satellite connection.




I chose this course of action because I believe it is an affordable approach to bring the community together by enabling them to interact among one another and promote a sustainable livelihood among the town's indigenous residents. Due to the lack of a requirement for cell towers, employing a centralised public internet connection allows for the equitable distribution of internet access without causing any harm to the environment or affecting the connection to the country of indigenous people. This will guarantee that their relationship with their country is not harmed, and the community will have a more dependable internet connection to provide them access to banking, healthcare, education, and other essentials to give the community a healthier and higher standard of living. Rural areas are required to maintain and offer high-quality telecommunications infrastructure due to their low population density, high cost, and limited availability of other kinds of communication and transportation. As the community's sole method of telecommunication, the alternative offered to them must be robust and extremely reliable. When communicating through a MAN, which is frequently speedy, high-speed carriers, like fibre optic cables, can be employed.




A metropolitan locality association (MAN), a type of PC coordination, frequently includes a full park or downtown (MAN). By connecting LANs with quick spine headways like fibre optics, it enables enterprises to interface with the wide-locale association (WAN) and the web. In metropolitan areas, data transfers are relatively quick while propagation delays are somewhat long (MANs). For MANs, there is less network congestion and less failure tolerance. MANs are frequently expensive and may be hosted by a variety of organisations. This MAN is ideal for connecting offices in one community within its service range because it has a broad network and a coverage range of up to 50 kilometres. MANs employ a range of instruments, including modems and wires/cables, to transmit data. A cable provider's local network and a phone company's high-speed DSL network are two instances of MANs.



## Design Specifications

The existing NBN satellite link is required by the project's architectural specifications. The LAN modems for the community's new Metropolitan area network must already be connected by Bamaga.

For a system to work, certain pieces of hardware are necessary.

The hardware found below are all a part of the 3 Layer Network Architecture Model, allowing for all components to work in conjunction with one another, under the access, distribution, and core layer/s.

1. NICs, or networking interface cards: In order for a computer to connect to a network, a network interface card (NIC) must be placed into the computer. Every networked device has NICs. The PC's opening can accommodate an extra NIC board or a motherboard with a compatible NIC.

2. Server: A business server is referred to as a computer that manages requests and sends information to other (client) computers on a local network or the Internet. A server can be one of three things:

    - File Server:  A document server is a computer that maintains records, is connected to an organisation, and grants shared access to those records to various workstation computers.
    - Print server: Using a network, a print server connects client PCs to printers. It collects print requests from laptops and transmits the tasks to the authorised printers across LAN.
    - Communication server: A computer system known as a correspondence server is designed to manage a few programmes that depend on exchanges.

3. Station: Using a local area network, a station connects to a server computer and can communicate with other devices attached to it (LAN)

4. HUB: a hub where all networked devices communicate with one another. LAN segments are frequently connected via hubs. A hub has a number of ports. Since each packet that comes at one port is copied to the other ports, every LAN segment may see it.

5. Switch: A switch can recognise a bundle and directly send it to the target PC in place of a middle, which acts as a hub for connecting network connections.

6. Router: Routers set up the Web association for LANs. They use a design data collection to decide where to deliver packages..

7. A wireless device's ability to connect to a wired local area network is enabled via an access point, which is either hardware or software.

8. Power Supply: For both wired and remote organisations, a power source must be available. Wireless networks generate radio waves using the current. Data is read as an electrical pulse that has been transferred through a cabled network.

9. Connector: An organisation connector is any device that connects the PC's hardware to numerous LAN associations.

After installation, the physical components of the MAN must first be made operational. Without software, devices cannot function properly and cooperatively on the MAN. A MAN may contain one of three types of software:

The brains of the network are thought to be the server operating system. Operating systems are required for PC operation. In addition, software applications and applications that MAN users can access are programmes called applications that are used to conduct tasks. Database management, spreadsheet analysis, and text processing are among the most widely used business apps.

## Design Benefits

The benefits associated with my design idea should help to improve the communities' livelihoods as they will have a much stronger and more easily accessible connection to a reliable internet source. First of all, I think this will strengthen the bonds between members of the community and enable the native residents of the township to interact with other groups and families from other neighbourhoods or regions of the nation.

- High Speed - *Appropriateness*: The fast data transmission speeds for files and databases are made possible through MAN's fibre-optic infrastructure.
- Soon, transmission speeds will surpass 1000 Mbps.
- Customers can share their internet access after installing MANs, enabling high-speed internet for a big user base - *Access and Equity*
- In comparison to WANs and LANs, it offers excellent security, and data in MAN is frequently secure - *Safety*
- The MAN network can be easily connected to the WAN network because it is less expensive - *Affordability*
- Strong data effectiveness is provided.
- The central management of all MAN data is easy to use - *Access and Equity*
- It is quick and simple to convert from LAN to MAN.
- Less equipment is needed for shared networks, which is better for the environment - *Environmental Health*

## Design Constraints

The implementation and maintenance phases of this project must be carried out without endangering the surrounding environment or the community's deep ties to the land. High-speed internet is made possible for many users through the installation of MANs, which allows consumers to share their internet access. The town's lack of accessibility is another restriction to take into account. Given that the project is in such a remote location, every journey the team makes there must be efficient in terms of both time and money. In addition, there is just one network available for this town to use, therefore there is no option for network shopping. Since the town already has a high cost of living, the choice offered must be dependable and affordable. Due to the terrible condition of the town's roadways, upkeep must be simple and economical for the locals to handle themselves since outside support may take weeks to arrive. For this project to be practical, the design must be strong and able to survive the elements.

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# Design Idea/Concept #5 (Education) - Kayes and Moriom

## Learning Issue

A small town with a 40-kilometre size, Bamaga is located in the northern part of Queensland, Australia. It is a region of NPA with a population of approximately 1164. There are 20% of them.75% of islanders are indigenous. (Thomas, 2018). The educational issue is among the most crucial problems to bring up since good education for city dwellers will help them learn about technology, which will help them obtain more jobs in the field to raise their standard of living. The main obstacles to education are inadequate Aboriginal role models and irrelevant teaching materials. The community and informed parents must work well together to support Bamaga’s education.

In rural places, there is a severe lack of English teaching resources. In remote places, English is not the primary language spoken by pupils who identify as Aboriginal. An assessment of current textbooks revealed that Aboriginal history receives little attention.

Books primarily discuss non-Aboriginal people's experiences and only briefly mention the lives of Aboriginal people. (Jens Korff, 2022). More than a quarter of Australian educators who were surveyed concur that they lack the training required to educate Aboriginal pupils properly said Jens Korff (2022). Recent research found that in the Northern Territory, only 47 cents of every dollar spent on public education went towards instructing students in remote communities.

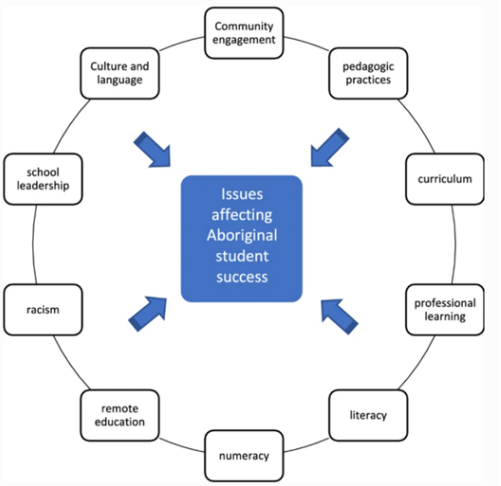



*Figure 1 (Lowe et al., 2019)*

Here are some potential learning issues to Bamaga Students and local people that are related to education.

1. Lacking in teaching Materials

2. Limited Aboriginal Academics

3. Poor Teaching quality

4. People are not willing to learn

5. Not enough awareness for education

6. Lack of infrastructure

7. Segregation by skills levels

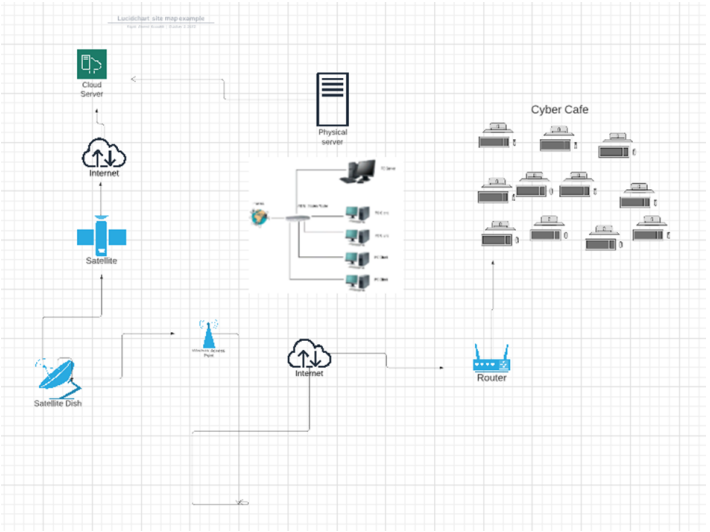
## Design Concept

The design we are going to make specifically for the people of Bamaga that mainly provides them the easiest way to get access for education using the Digital connectivity infrastructure for remote communications. In our design, we will provide them an online Education platform by providing them free high-speed internet that covers a wide area. Our main idea is to provide a cybercafé where local students of that area, including the mass people of all ages can educate themselves. They can access that cybercafe anytime that is totally free of cost.

There, they can access computers with the internet where they can study, research, learn and develop new skills etc. But before that, we need to teach them how to access that cybercafe and how to use or operate computers for learning purposes and for that reason we will create an online learning platform where they will teach themselves by the guidance of a tutor who is well educated enough to teach them about that platform.

In that online education platform, all the studying data, information will be stored that can be accessible by all the people of that area. There will be all kinds of educational contents, technical skills learning, daily life skills etc to educate the people of Bamaga, so that they can implement that in their daily life in a very convenient way to make their life easy.

For this design, we will set up 20 computers in one cybercafe. There will be routers that will provide wireless networks to access the internet. We might need to use a server to store all the data of that online education platform. To properly set up the whole thing we will need to deal with some professionals in that area. The cybercafé will connect to the internet by the LAN that has to relate to a local tower. That tower will get information, data from a cloud server where all the data will be stored by the help of a satellite. And so, we also need satellites to implement the whole idea properly.



## Design Outline & Specifications

For the project design we are going to use these devices found below. These all relate to the 3 layer network architecture:

- LAN (accumulation of all devices)
- Router (distribution layer)
- Cloud Server (core layer)
- Connection to Internet (wireless - access layer)
- Network Tower (core & distribution layers)
- Computers (end devices)
- Projectors (end devices)
- Satellite (core & distribution layer)

The idea of universal access to the internet is so intriguing. It is a genuinely amazing fantasy, and one that will someday come true, to think that everyone in the globe will be able to witness this phenomenon. Currently, the majority of places can connect to the Internet, but many isolated places still cannot. Remote locations require the provision of wide area network (WAN) links.

Wide area networks are an idea that has been around for a while but is still significant in networking today. These networks are what bind together the entire Internet thanks to their numerous links. There are other network types that offer access like this as well, such as metropolitan area networks (MAN), which are effectively a WAN and a LAN combined in a more defined space, but that isn't the subject of this guide.

We also require devices. But when it comes to gadgets, we also require the ones that connect us in addition to the amazing tech that translates the Internet into language we can understand. Analog to digital and digital to analogue signal conversion is done via modems. the apparatuses that send the signal out into space or along the wire connecting us to the other side. The equipment to meet us on the other side.

Anyhow, the next step would be to distribute the access after you have the modem's service connection created and it can communicate with the ISP and access the Internet! Although hardwired routers exist, wifi routers are quite prevalent in all contexts. In order to provide everyone with that amazing Internet connection, one or both of them (depending on the end user equipment you have) will need to be plugged into the modem. (Abraham, 2019)

We are going to be using different types of network devices for our project. We need mostly network devices like routers, LAN, Network tower, Wireless network point, internet provider and lastly satellite. To transmit the data to the internet, we also need access to satellites.

Due to the low cost, low power consumption, and low bit rate of Connected devices, the data centres will assist in storing the data from these devices before sending it to the router. To access the data, the router will assist in sending the data to a wireless access point. As we need to alert, the router will also broadcast the data to a LAN network.

## Design Benefits

### Access & Equity

We have come up with a solution that can be accessible by all mass people of that area 24 hours. Anyone can access that Cybercafé for any kind of learning purpose, research etc. Since we are providing free high-speed internet with maintaining safe Search for the people under 18, they can get the best out of it and implement it in their daily life and make the best use of technology.

### Health & Safety

This project is mostly focused on Education, but it can be used for other purposes as well. By providing free internet in Bamaga, we can raise awareness about health and safety among the people of that area.

### Appropriateness

The design idea we are sharing for this project is basically for the people of Bamaga and we did our best to cover all the criteria and requirements of the project and hopefully it will cover up everything, specially from the education side.

### Affordability

We tried to reduce the cost as much as possible. The devices and hardwired we are going to use for this project are so affordable in terms of use and cost. We might need satellite access to implement this idea and we need some specialist to set up the whole project in Bamaga.

### Environmental Health

In this whole project we kept that in our mind to make sure the project is environment friendly, and we are aiming to keep that promise. We made sure that this project doesn’t affect the environment, by using less materials that affect the environment.

### Sustainable Livelihoods

Natural resources won't be impacted, and no other development will be affected because of this design concept.

## Design Constraints

We are using a lot of network devices and professional people to implement the whole idea properly in a good way. We are using most networking devices cause it's all about Online education learning platform using digital Connectivity Infrastructure. We are using routers, LAN, computers, Wireless network access point, server, cloud server etc for this project.

There are a few disadvantages for this project. Since most of the people have no knowledge in technology and in other digital connectivity infrastructure as well. So, it would be kind of difficult to teach them about this kind of stuff.

For those with limited resources, an Internet café allows access to the Internet (Adetoro, 2010). Internet cafés are a type of informal learning setting where social contact is at the centre of offering drop-in access to computers and the Internet for hourly rates. (Hansson & Wihlborg, 2009).

Since our main goal is to provide them with the best and convenient project idea to solve their education problem, this would be the most usable idea for them to find the best solution in a better way.

The proposal is inexpensive to implement the whole project idea. Implementing the latest communications antenna may come with some upfront costs. The Bamaga community and local governments will be responsible for paying these expenses for this project.

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## Team Task Breakdown

**Part A:**
Project Overview - Moriom
Project Requirements - Kayes

**Part B:**
Design Idea/Concept #1 - James
Design Idea/Concept #2 - Shreeya
Design Idea/Concept #3 - Elijah
Design Idea/Concept #4 - Nahid
Design Idea/Concept #5 - Kayes and Moriom