2025 COMP3310/etc

Assignment 1 – The Last Mile

Intro:

This assignment is to develop a (short) technical report that deals with a variety of network design aspects relating to building a last-mile network, with the last section making a specific design recommendation for a semi-fictitious rural setting.

You are encouraged to research widely, then interpret and present your findings. Most marks will be given for deeper analysis than just repeating lecture content. You will need to find more background information to answer all the questions in good depth.

Submitting:

- This assignment is worth 15% of the final course mark.
- It is due by 23:55 Friday 21 March.
- **Late submissions will not be accepted**, except in extenuating circumstances. Extensions must be requested, via the wattle link, with appropriate evidence, and as early as possible. Plan ahead!
- Submission will be via *TurnItIn*[1] through the link on the wattle page for this course. You can work together on the research, but your submission must be **entirely** your own work, with appropriate citation of your sources and any other technologies used.

Questions:

For the three brief questions Q1-Q3, each answer should be about 0.5-1 page long. These questions set the scene for your analysis in Question 4, you can reference them there. The design in Q4 should be around 1200-1500 words long. Longer is ok, but don't go crazy, there won't be extra marks.

Q1: Why is a Last Mile network such a complex but also vital issue in Networking and Communications? [3 marks]

Q2: What are the main, typical, options for delivering Last Mile networks in Australia, NBN or otherwise? [4 marks]

Q3: What are the actual technical (physical) limitations on data-rates across the various Last Mile network technologies? [3 marks]

The above answers are input to the following design challenge. You must include appropriate diagrams and any necessary tables, to help explain your arguments.

[1] You should look at TurnItIn's feedback to ensure you have properly referenced external materials. You can submit multiple times up to the due date. We don't use the TurnItIn score in the mark, it's only a potential flag.

Q4. Develop a basic network design to meet the following needs of a rural community [20 marks]: Home broadband can be delivered through a range of cabled and wireless methods, each with their own costs, limitations and benefits. For this part of the assignment you need to provide a brief technical report for a rural community network organisation. Please write to a reasonable level of technical understanding, but don't blind them with jargon.

The community of the village of Bungenwood wants to build their own shared network for 256 farms, across their interestingly-laid out region, through a common infrastructure – i.e. everyone gets the same connection, if not the same performance, to keep the maintenance simple. The minimum requirement is that every farm gets 50Mb/s down, though anything better is welcome.

The sketch below shows the layout of the farms. They are conveniently laid out on two touching concentric circles of roads, each with four ring roads (radius of 0.75, 1.5, 2.25 and 3km) and four cross-roads at 45degrees as shows. Along each segment of each ring there are four equally-spaced houses (only the outer ring houses are shown in the diagram).

Every home has a 50m driveway connecting it to the ring road just outside of it, and every home has a working copper phone landline (POTS) from the nearest of the two centrally-located exchanges. There's also a 4G mobile phone tower on each exchange. But that's all there is today. Both the exchanges and the 4G phone coverage provide connectivity back to the wider internet – you just need to reach them. You can also use the towers on each exchange for your own purposes.

Fortunately the local Council is very supportive, you can build what you want, but requires any new infrastructure (trenches, poles, cabinets, …) to be along the roads and house driveways only, i.e. don't go through backyards. You can also use the existing towers at the exchanges.

a) Describe (briefly) the various approaches that could be deployed and what a deployment would look like in each situation:
    a. Outline various copper/fibre cable approaches, what kind of equipment and cables (copper/fibre) are needed where, and how much is needed.
    b. Outline some reasonable equivalent wireless options.
    c. Your analysis should include expected downstream/upstream performance, and any limitations. Simple diagrams will be very helpful.

b) Pick one cabled and one wireless approach, and explain in more depth which of the two you would recommend, and why. Highlight any assumptions or simplifications you need to make, and any risks you see. It's only a short first report for the organisation, they'll go get a lot more data based on your advice.

c) For your two designs, estimate the **deployment** costs, using the following indicative pricing, for any new stuff. Note that not all the necessary equipment may be here, so you should flag anything else you think is needed. You should also briefly describe what **operational** costs you might expect longer term. What would it take to run your network for the next 30 years?

    a. Fibre: $10/meter for new cable (1 pair of fibres), and $300 for terminating each end
    b. Copper: $6/meter for new cable (1 pair of copper), and $150 for terminating each end
    c. Wireless transmitters that may be suitable:
        i. Omnidirectional antenna = $100,000 each at the exchanges to cover a circle 3km wide, plus $500 per house connected that way.
        ii. Point-to-point links with 4km range = $600 at each end.

d. Converting one fibre to one copper cable (and vice-versa) is a simple $50 powered unit
e. Converting one fibre to 16 copper OR fibre cables is a more expensive $1,000 powered cabinet.

*(Yes, these numbers are **extremely** rough, but they do cover outdoor grade coax/UTP/fibre, they include much of the active equipment at each end, and they magically support whatever kind of LAN-protocol-specific equipment is needed for each technology. It's a start!).*

There are **many** different ways to come up with a solution, don't go too far. **Note, there is no single 'right' answer**, and without a specific site survey, more detailed pricing and a lot of other information it is hard to even define the 'optimal' answer. The aim is to analyse the problem, develop a few simple potential solutions, and make a strong argument as to which options lead to the best outcomes.

Marking and Feedback

Reminder: There are **four questions,** with the last one containing multiple parts; please check you attempted all four before you submit.

For all questions, **cite all your sources** appropriately (use whatever citation style you are familiar with) and be clear where you are quoting and/or paraphrasing your sources. Lectures are not citable sources. Marks are given for your own work, not the work of other people/machines.

We're looking for your ability to take the broad concepts covered in class, together with a good bit of research, to come up with your own summaries of the issues and opportunities that a less-experienced person can still understand. Large-scale cut-and-paste slabs of information from various websites, even properly cited, are not going to score as well compared to a nice interpretation of the available information. It should be sufficiently technical to explain your proposals costs and benefits.

The marking for this assignment will be done via TurnItIn, which provides a total mark as well as some comments/suggestions.

Feedback: If there is a particular area or aspect of your work you would like specific feedback on, please mention that at the top or end of your assignment. Your tutor can then provide additional comments accordingly.

Self-assessment:

- Have you covered each question with some breadth, i.e. the range of technologies, and demonstrated some insights – or have you just paraphrased some internet content (human/machine generated)? Even when citing others, it is your reasoning we want to see.
- Did you consider a variety of approaches to the designs? How many different ways can you deliver cabled or wireless connectivity? Which ones are less desirable, and why?
- Have you explained things to the intended audience, as described, or blinded them with jargon, or written it for a complete beginner?