CMPG 315 – Computer Networks Group Project

Group 04

GROUP MEMBERS:

Bégué, Jean-luc	–	40779173
Cloete, Jacques	–	44214987
Coetzee, Christian	–	40513262
De Meyer, Maderi	–	40977676
Le Roux, Danika	–	41049764
Mooiman, Henk	–	41293584
Nieman, Waldo	–	37943278
Pretorius, Andre	–	41093615
Truter, Ariel	–	38566567

Table of Contents

Group Task 1: Preparation (Reflections)

Bégué, Jean-Luc – 40779173 :

I've developed a number of soft skills through various courses that are crucial for both professional and personal development. The Mini Course on Time Management's emphasis on time management helped me learn how to set priorities for my work, manage my time well, and stay focused in the face of distractions. My cooperation abilities have been enhanced by Git that started with GitHub and Become an Expert in Git & GitHub, which emphasizes effective communication, teamwork, and dispute resolution throughout project work.

Project and project management taught leadership skills that are essential for managing successful projects, include goal setting, work delegation, and change adaptation. Additionally, by modeling actual networking situations and encouraging analytical thinking and troubleshooting techniques, Cisco Packet Tracer improved my problem-solving abilities. Together, these classes cultivated resilience, flexibility, and a proactive mentality that enabled me to effectively tackle problems in a variety of professional situations. The soft skills I've gained are priceless assets that have shaped not just my professional path but also my personal growth and pursuit of lifelong learning.

Cloete, Jacques – 44214987:

The first thing I noticed from the Mini Course on Time Management was that I make myself busy with things other than the important thing that needs to be done which is a form of laziness and procrastination. By investing the beginning my day into myself instead off others will help me to maintain a clear mind as well as be more productive throughout the day. I took plenty of notes from this course in order to organize my tasks, schedules, and priorities efficiently. From past experience I have realized that spreadsheets don't work that well for me, but the rest of the content provided was a good refresher of the concepts I already understand.

By seeing time management as a tool, I can feel more positive and self-aware about my habits and the areas of my life that need improvement. By managing my time, I can try to achieve my goals easier than before when I was not implementing these soft skills learned in the courses. The “Git Started with GitHub” course was a very good introductory course, it had lots of hands-on practice and theory about Git and GitHub. I feel that my teamwork soft skill has been greatly improved after this course, especially by the fact that this skill is used quite often in the software development world. I am looking forward to applying the knowledge I have learned.

Coetzee, Christian – 40513262:

The following courses were expected to be completed.

- Course 1: “Manage your time.”
- Course 2:” Git started with GitHub.”
- Course 3: “Git expert 4 hours”
- Course 4: “Project and Project management”
- Course 5: “Cisco Packet Tracer”

Course 1 taught me about how the management of your time can change your life for the better. Just sleeping and waking up at a set time everyday can improve your mood/ energy for the rest of your day. Consequently, this course made me rethink my routines (or lack thereof) and implement some elements that they mentioned.

Course 2 was a recap about concepts that I already knew from other modules and courses. But it seemed like a good way to understand how Git (GitHub) works as the core was always command line “prompting”. I would also say the same about course 3 as it went more in depth about how the functions work and how to enable some of them (via command line).

I read the materials given by course 4 as they were easier to understand than the person narrating. It was interesting to see how one would such techniques in projects and development.

Lastly, course 5 was very entertaining and interesting to learn. It taught me the different things to look out for and how different components/ devices/ cables work dependently and independently. I enjoyed this course very much.

De Meyer, Maderi – 40977676:

The first course gave 7 practical steps for time management. The quote “It is not that we have a short time to live, but that we waste a lot of it,” made me think twice about how efficiently I use my time and in what I invest it. I should have set rituals and minimize the number of potential distractions I have around me.

The second course gave me an overview of GitHub, from installing it, setting up a project folder and using the pushing feature, to command references. The third course went into more depth, and covered all the basics of Git, as well as GitHub and SourceTree. This is a great tool to use when multiple people have to work on the same program and is therefore ideal for group projects.

The course about projects and project management outlined the fact that I should first understand the structure of the project, before just rushing into it. Project management process groups consist of initiating, planning, executing, monitoring, controlling, and closing. It taught me the different knowledge areas for project management. Furthermore, it explained different schedule management techniques: Three Point Estimates, PERT and Critical Path Methods as well as precedence diagramming methods, dependency determination and schedule network analysis. Lastly it provided a few tools that will assist in project management.

In the last course, I learned what Cisco Packet Tracer is, how it works, the different file types, and how to build a network, configure end devices and verify connectivity.

Le Roux, Danika – 41049764:

I have really developed and refined a number of soft skills during these courses that are essential for both career and personal growth.

The "Manage Your Time" course's lesson on time management has been quite beneficial. I now know how to maximize productivity, prioritize activities, and create attainable objectives. This ability has helped me manage my job and personal lives better by lowering stress and increasing efficiency.

Participation in the Git and GitHub classes improved teamwork and communication abilities. Acquiring proficiency in version control systems promoted smooth collaboration, resulting in efficient coordination and communication. Smooth cooperation was guaranteed via explicit commit messages and branching mechanisms, highlighting the significance of accuracy and clarity in concept communication.

I gained the organizational abilities necessary for project planning, execution, and evaluation from project management classes. Comprehending project scopes, timeframes, and stakeholder management enhanced my capacity to effectively lead and participate in initiatives. I also learned more about decision-making and problem-solving techniques, which are essential for overcoming obstacles in a variety of project situations.

Finally, using Cisco Packet Tracer improved my technical expertise and flexibility. Quick thinking and troubleshooting abilities were necessary to navigate intricate network simulations, which promoted adaptation in quickly changing contexts.

In summary, these classes have not only given me the technical know-how I need, but they have also helped me develop the soft skills necessary for both professional and personal development. The skills acquired are priceless for managing a variety of aspects of life and business, from time management to teamwork and flexibility.

Mooiman, Henk – 41293584:

Reflecting after completing these courses made me realize that this process enriched my life with practical skills and invaluable insights. Initially I was worried about when I would find time to complete and work through all of these courses. After I started with the first course which was time management, I realized that this task was completely possible. I managed to rearrange all my other daily activates to make space for this project. Learning to prioritize certain tasks, to allocate resources effectively, and to mitigate procrastination has not only improved my life for the better, but also reduced some of my stress.

Initially navigating GitHub seemed extremely difficult, but as the courses progressed, I grasped its essence of collaboration between developers and how it is a version control software to safe- guard the projects you are working on, and also share the projects with others and collaborate with them easily. Project management principles and the technique to mitigate the project constraints such as cost, time and scope is very valuable information. I will certainly use it in this project, since working with a team and meeting deadlines was an area I was rather unsure about, but essential for this project.

Cisco Packet Tracer introduced me to the world of network simulation, how network configurations work, as well as the different troubleshooting methodologies. This hands-on experience solidified my knowledge and comprehension of networks.

I am looking forward to implement this new knowledge in this project.

Nieman, Waldo – 37943278:

The main objective for this task was to complete 5 different online courses and write a reflection in which you discuss the soft skills you have learned upon completing these online courses. I found each of the courses very interesting and helpful, I learned a few new things in each of the courses but there were a few things that stood out for me and changed my perspective.

In the past, I have struggled to properly manage my time and fit everything into my daily schedule. Through these courses, I've learned that I should only spend time on the things that will benefit my future and will give me something in return, and work for short periods but work productively (put away all distractions).

The courses on GitHub and Project Management gave me more certainty on working effectively within a group. I now understand GitHub a lot better this course clarified a lot of uncertainty for me, and I feel a lot more confident in working with GitHub and exploring the great features that GitHub has to offer for group projects. The course on cisco packet tracer was very loaded with information, I learned more about networks (cables, devices, etc) I found this course very interesting and helpful.

These courses changed the way I look at certain things and my perspective on group work and how easy it can be if you use helpful tools, I look forward to implementing the things I've learned in the rest of this project.

Pretorius, Andre – 41093615:

Throughout these courses I have learned several new soft skills. In terms of time management, I have learned that my time has to be invested into activities that would benefit me, instead of just wasting my time on menial tasks. Instead of thinking about what I need to work on or do at the present moment, I have learned to plan my daily activities and set goals for myself. Through planning my day, I have been able to accomplish much more than in the past.

I have also learned to work in chunks of uninterrupted time and to fully cut out all distractions that might interfere with my concentration. Since I have been organizing my goals from most to least important, I have learned to accurately divide my time between these goals. I have also learned to use Git and GitHub to its full extent and learned about several new features. I now better understand how Git and GitHub works in terms of version control and how it tracks changes to files on several diU erent devices. By completing the Cisco Packet Tracer course, I have learned that it is used to practice building networks and how it can be integrated with various other technologies to form more complex network systems.

Truter, Ariël – 38566567:

Soft Skills Learned from Udemy Courses

Engaging in the Udemy courses provided valuable insights into soft skills essential for personal and professional growth. A fundamental principle emphasized was the distinction between education through application versus mere memorization. This concept resonated deeply, highlighting the importance of practical implementation over rote learning.

Time management emerged as a pivotal skill, with Seneca's wisdom echoing the significance of utilizing time effectively for meaningful accomplishments. Through techniques like redefining time management, establishing routines, and prioritizing tasks based on the 80/20 rule, I learned to optimize productivity and achieve desired outcomes efficiently. Moreover, understanding the value of planning, tracking progress, and embracing gradual change reinforced the notion of continuous improvement.

In the realm of project management and Git, collaboration and communication skills were honed. Learning about project management processes and Git fundamentals underscored the importance of clear communication, effective teamwork, and adaptability in achieving project goals. The courses provided practical strategies for navigating project phases, managing stakeholders, and leveraging version control tools for seamless collaboration.

Moreover, the courses facilitated the development of critical thinking and problem-solving abilities. By delving into complex concepts and practical applications, I cultivated a deeper understanding of project management principles and Git functionalities, enhancing my analytical skills and decision-making capabilities.

Overall, the Udemy courses not only equipped me with technical proficiencies but also fostered essential soft skills vital for success in various domains. Through reflection and application of these learnings, I aspire to continually refine my skill set and contribute meaningfully to future endeavors.

Van Tonder, Anri – 37328409:

The first training “A Mini Course on Time Management”. The 80/20 rule is brilliant for helping and prioritising one’s goal, with time left to do other smaller, yet necessary tasks. This, along with the point of having no distractions, were my biggest learning points from this course.

Reflection on “Git Started with GitHub” and “Git: Become an Expert on Git & GitHub in 4 Hours” training. I have previously used GitHub but without Git Bash. Revising was helpful in better understanding what each functionality was for. An example of this would be realising the difference between cloning and forking.

What I gathered is that Git Bash can be more versatile than Git Desktop, although I initially thought it was unnecessarily complex. Git source tree, on the other hand, I found more familiar because of the GUI. I found this helpful with the visualisation of repository history, changes made and managing workflow.

Through the “Project and Project Management #” training, I have learnt that the project structure is a good blueprint for success. Additionally, project management tools such as MS Projects and Primavera P6 can greatly aid in productivity through visualisation and communication.

For the “Getting Started with Cisco Packet Tracer” training, I learnt how to configure network interfaces and design networks. I also learnt of other features such as network topologies, routing protocols and real-world networking challenges.

The abovementioned is only the tip of the iceberg of what I learnt. I hope to hone these skills throughout the rest of the project.

Group's working procedure:

Summary of work ethic from group:

When work would be done:

- We would all try to do our part when possible.
- For example:
  - After classes (potentially alone at home), late nights (if necessary) and when we have group meetings.
  - Some people also work better alone and some work better with groups. So, a dynamic approach could be considered where we use discord etc.

Where work would be done:

- If some were to work alone, it would typically be where one could concentrate on the tasks. For example, a library, home or maybe even in classes.
- If some were to work in groups, it would be at someone's house/ flat, or a conference room at the library, or even at a public area inside campus (like on grass, or Monday class etc.)

Manner of work being done:

- We should all try to help each other whenever possible but be certain not to take advantage of this help received.
- Try to finish best to our abilities and understanding.
- If we were to struggle with a task, to ask for second opinion to ensure your thought process was correct.
- The members are serious about their work and known for putting effort in their work, thus no slacking should be expected.

What group considers a delinquency:

- Absence from group meetings.
- Not contributing and adding value to group.
- Slacking with work and not making deadlines.
- Not pulling one's own weight.
- Disrespecting one another.
- Plagiarism in terms of "copying and pasting" work that was already done by someone/ something else.
  - For example, a former student etc.
- Lying and dishonesty.
- Substandard quality of work.

Communication Channels and collaborations:

WhatsApp groups were used to arrange a time and place for meetings as well as sending relevant documentation on. Sometimes phone calls would also be made to try to understand some concepts when a meeting would not be able to be arranged. Discord was also used for a meeting when not everyone was in Potchefstroom, it was also used to work together on some rooms (network diagram Packet Tracer) by some teams. Otherwise, meetings and small group meetings would be held to discuss expectations and workload etc.

Group Task 2: Continuous Reporting

Notes and attendances:

Group Members Meetings:

Group 4 Meetings:

Names	Surnames	Student Numbers	Monday 2024/03/04	Thursday 2024/04/11	Tuesday 2024/05/07	Wednesday 2024/05/15
Jean-Luc	Bégué	40779173	Yes	Yes	Yes	Yes
Jacques	Cloete	44214987	Yes	Yes	Yes	Yes
Christian	Coetzee	40513262	Yes	Yes	Yes	Yes
Maderi	de Meyer	40977676	Yes	Yes	Yes	No
Danika	le Roux	41049764	Yes	Yes	Yes	Yes
Henk	Mooiman	41293584	Yes	Yes	Yes	Yes
Waldo	Nieman	37943278	Yes	Yes	Yes	Yes
Andre	Pretorius	41093615	Yes	Yes	Yes	Yes
Ariël	Truter	38566567	Yes	Yes	Yes	Yes
Anri	van Tonder	37328409	Yes	Yes	Yes	Yes

Group meetings were held in the afternoons. Most members were available in these times.

Notes and Conclusion:

Date	Notes	Conclusion
2024/03/04	Meet and greet. Talked about project and read through the documents. Discussed how the group dynamics could work, for example making smaller teams of two or three. Would ideally be of different skill sets. We also discussed when and where we could meet in the future (agreement on the library, Discord). Use GitHub for documents etc. Lastly, we discussed what everyone should do and then we agreed on a deadline.	We agreed on the following: Completing the course work with deadline of 18 March, creating a GitHub repository, and joining it in the meantime, creating a Discord server, have our meetings in a “boardroom” at the library and choosing a group leader.
2024/04/11	Meeting held on Discord as it was the week where Potchefstroom had some water problems and online classes were allowed to be held. Members were allocated into teams randomly and tasks were also allocated randomly. Everybody also agreed on allocations and draft documentation for project timeline etc.	Discord meeting went well, but some would rather meet in person. Teams of two would have their own meetings where they would do the allocated tasks and record their meeting times.
2024/05/07	Meeting held in the library. We discussed how far we were with our parts of the tasks and the plan	Everybody gave input and some volunteered to do certain tasks. The group was divided into Front End,

	forward in terms of the text messaging app and who is compiling what and when we would go over everything for the final time.	Back End and Front End/ Back End. Front End would design the GUI, Back End would do the necessary coding and the Front End/ Back End team would test the application. Meeting will be held on 15 May 2024.
2024/05/15	Meeting held in library. This meeting was held to finalize our documentation as well as our Packet Tracer files and Text Messaging Application. Everybody was willing to help and we also read through the draft documentation to ensure almost no mistakes could be made. It was a very productive meeting and everybody is mostly on the same page. We also read through the documentation and rubric again.	The relevant people of the documentation ensures that the formatting of the document was acceptable, professional and easy to read. The developers made sure the recognized bugs were fixed and in portable state. The people that compiled the Packet Tracer files ensured the Packet Tracer works as intended. The group also made sure the documents and relevant files fulfills the requirements of the given rubric.

Team Meetings:

Team	Members	Rooms Assigned	Meet Date 1	Meet Date 2	Attendees
1	Cloete, Le Roux	13 Offices	2024/04/24	-	Cloete, Le Roux, *
2	Bégué, Pretorius	Reception, Open Floor Space	2024/04/18	2024/04/24	Bégué, Pretorius, *
3	Mooiman, Nieman	Server Room	2024/04/19	2024/04/25	Mooiman, Nieman, *
4	De Meyer, Truter	Kitchen, Meeting room, Open Floor Space(optional)	2024/04/17	2024/04/18	de Meyer, Truter, *
5	Coetzee, van Tonder	Technicians' Office	2024/04/16	-	Coetzee, van Tonder

**Coetzee attended first meeting of team to clarify what is expected.*

Team meetings were held when both members were available. Ranged from 07:30 to 18:30.

Compiling Packet Tracer files:

Members	Date	Time	Attended
Anri	2024/05/14	09:00 – 12:00	Yes
Henk	-	-	Yes
Jacques	-	-	Yes
Waldo	-	-	Yes

Developing Text Messaging application:

Members	Date	Time	Attended	Role
Henk	2024/05/14	19:30 – 01:00	Yes	Back End Leader
Andre	-	-	Yes	Back End
Jean-Luc	-	-	Yes	Back End
Danika	-	-	Yes	Front End Leader
Jacques	-	-	Yes	Back End/ Front End Leader
Ariel	-	-	Yes	Back End/ Front End
Waldo	-	-	Yes	Back End/ Front End
Anri	-	-	Yes	Back End/ Front End
Christian	-	-	Yes	Back End/ Front End

(Main developers were Jacques, Henk, and Danika. All other members were on standby for additional help if needed. Jacques and Henk did do some research and tests before our first meeting where we would talk about the text application.)

Assigned tasks and responsibilities:

Surnames	Student Numbers	Team Allocation	Roles
Jean-Luc	40779173	Team 2	Member, Back End
Jacques	44214987	Team 1	Member, Back End/ Front End Leader
Christian	40513262	Team 5	Member, Group Leader, Back End/ Front End
Maderi	40977676	Team 4	Member, Back End/ Front End
Danika	41049764	Team 1	Member, Takes Attendance, Documentation Formatting, Front End Leader
Henk	41293584	Team 3	Member, Back End Leader
Waldo	37943278	Team 3	Member, Back End/ Front End
Andre	41093615	Team 2	Member. Back End
Ariël	38566567	Team 4	Member, Back End/ Front End
Anri	37328409	Team 5	Member, Back End/ Front End

Members	Team	Tasks (Use Packet Tracer for designs)
Jacques, Danika	Team 1	Create the network design for 13 Offices. Helping Team 3 with Server Room was optional (if Team 3 needed help). Helping Team 3 with combining packet tracer files was optional (if Team 3 needed help).
Andre, Jean-Luc	Team 2	Create the network design for Reception/ Waiting Area and Open Floor Space. Helping Team 3 with combining packet tracer files was optional (if Team 3 needed help)
Henk, Waldo	Team 3	Create the network design for Server Room/ Machine Room. Compile the Packet Tracer files from the rooms and ensure it works. Describe/ documenting network topology after discussing with whole team.
Ariel, Maderi	Team 4	Create the network design for Kitchen and Meeting Room. Helping Team 2 with Open Floor Space was optional (if Team 2 needed help). Helping Team 3 with combining packet tracer files was optional (if Team 3 needed help).
Anri, Christian	Team 5	Create the network design for Technicians'' Office. Helping Team 3 with Server Room was optional (if Team 3 needed help). Helping Team 3 with combining packet tracer files was optional (if Team 3 needed help).

Role	Responsibilities
Member	Help where needed. Communicate concerns, ideas, and answers.
Group Leader	Ensures group stays on track. Schedules meetings and allocates tasks when needed. Also ensures the tasks completed, adheres to requirements communicated from lecturer/ the higher-ups. Also makes notes at meetings.
Back End Leader	Oversees the back end of the text messaging application in this case. Programs the application and ensures the application is optimized and portable. Communicates with the Back End/ Front End Leader to ensure requirements are met.
Front End Leader	Oversees the front end of the text messaging application in this case. Ensures the flow of the application is smooth and acceptable. Communicates with the Back End/ Front End Leader to ensure requirements are met.
Back End/ Front End Leader	Acts as “middleman” between Back End-and Front End Leaders. Sets out requirements for Front End and Back End, also makes sure requirements are met as set by the business.
Back End/ Front End	Dynamic developers that can be utilized by Front End Leaders or Back End Leaders, communicates with the Back End/ Front End Leader if someone is needed.
Documentation Formatting	Beautifies the documentation and ensures content is readable.
Take Attendance	Writes date down and checks if everyone is present at meetings.

Completed task sheet:

Because the dates stretch from March until May, uploading a single picture with details included is a bit difficult to read. So, sections are uploaded with the final picture representing a general idea of the timeline with the help of charts.

Link to repositories used:

Request link via email : christian.coetzee.jnr@gmail.com

PROJECT: CMPG 315 : Network Project

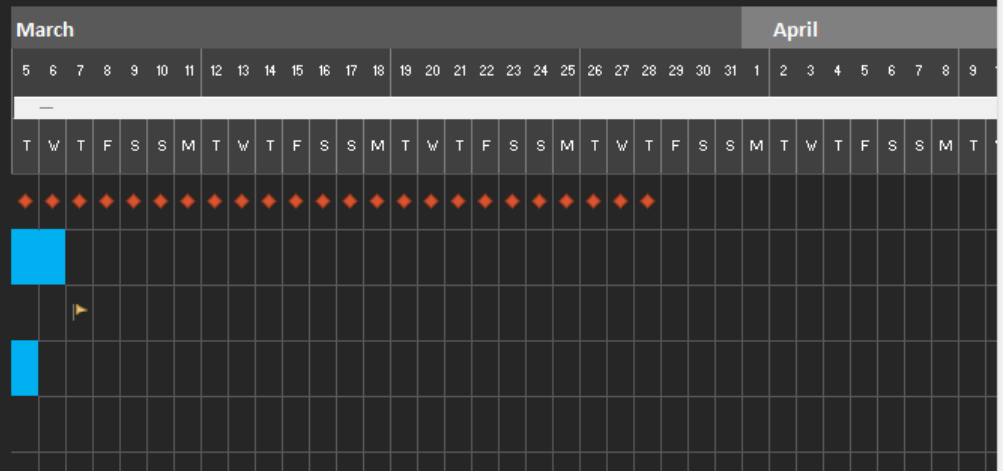
CMPG 315

Group 04

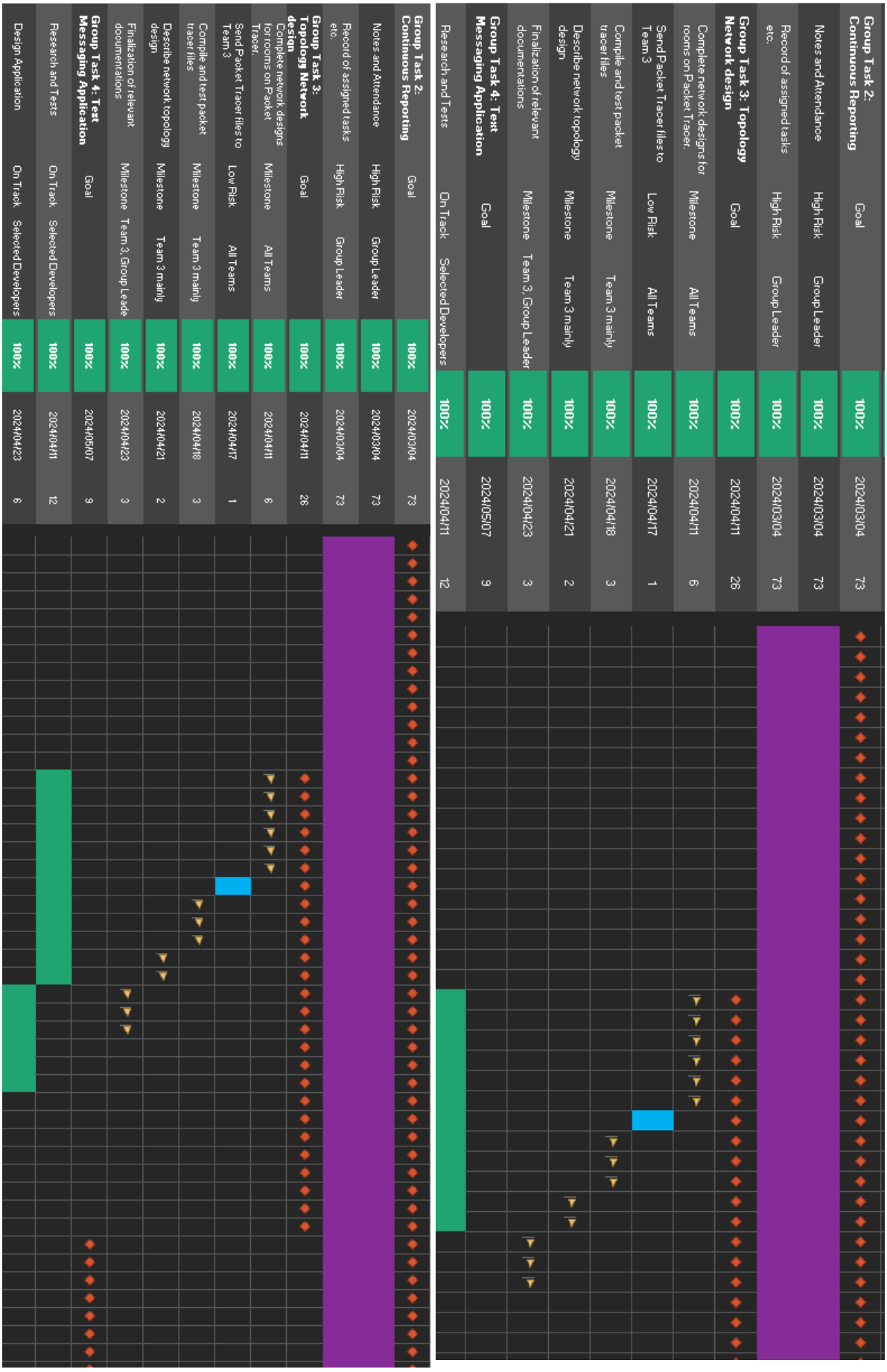
Project start date: 2024/03/04

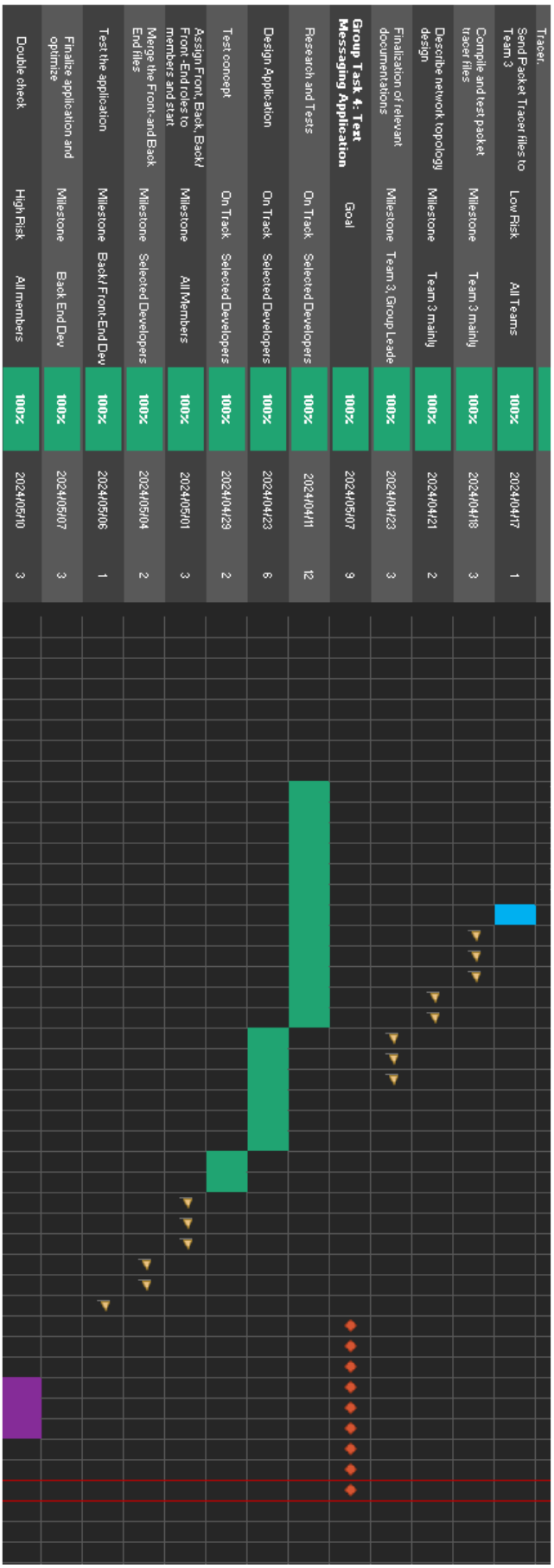
Scrolling increment: 1

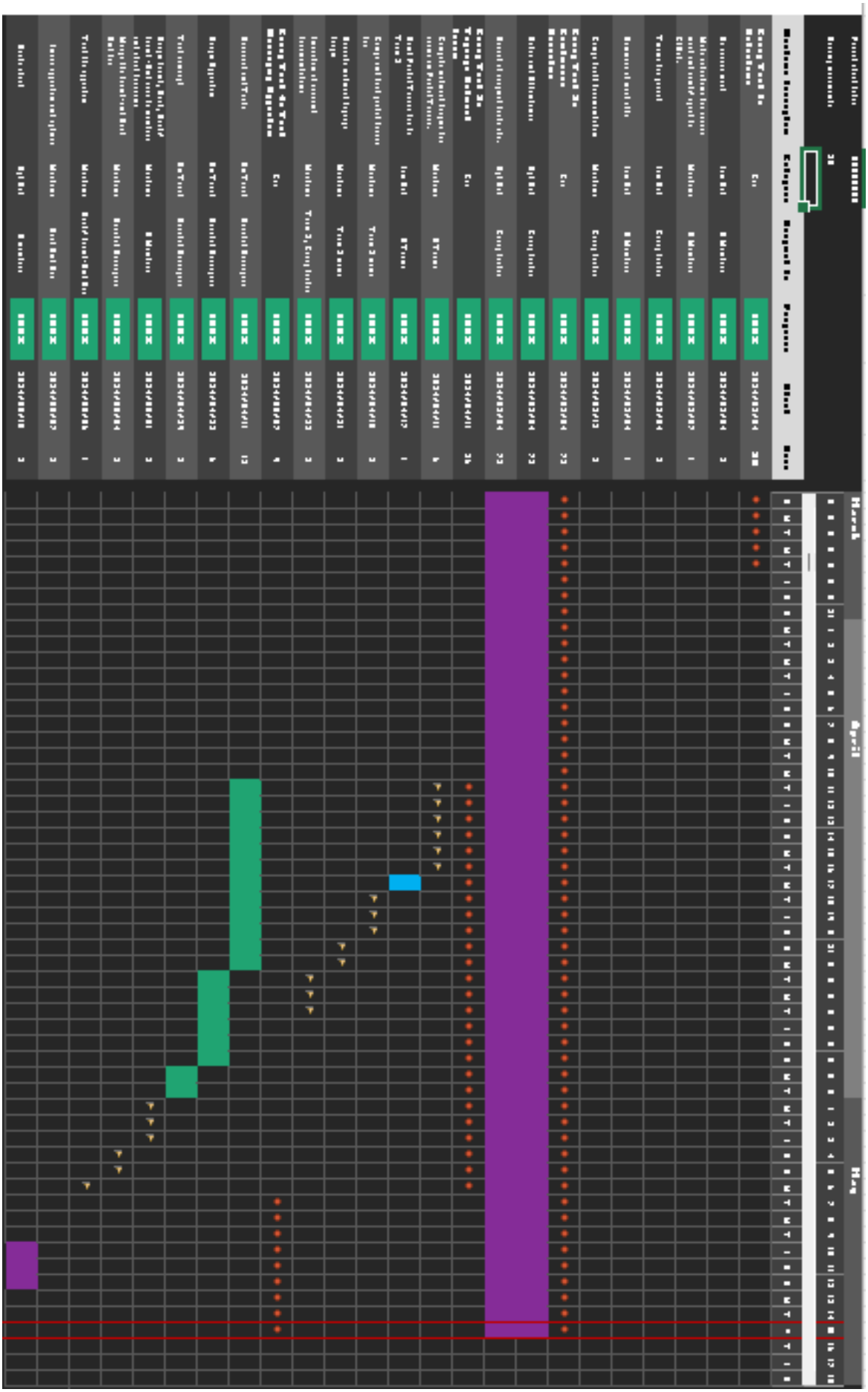
Legend: On track | Low risk | Med risk | High risk | Unassigned



Milestone description	Category	Assigned to	Progress	Start	Days
Group Task 1: Reflections	Goal		100%	2024/03/04	25
Do course work	Low Risk	All Members	100%	2024/03/04	3
Write reflections for course work and send/ upload to GitHub.	Milestone	All Members	100%	2024/03/07	1
Timeline for project	Low Risk	Group Leader	100%	2024/03/04	2
Summary of work ethic	Low Risk	All Members	100%	2024/03/04	1
GitHub.					
Timeline for project	Low Risk	Group Leader	100%	2024/03/04	2
Summary of work ethic	Low Risk	All Members	100%	2024/03/04	1
Compile draft documentation	Milestone	Group Leader	100%	2024/03/13	2
Group Task 2: Continuous Reporting	Goal		100%	2024/03/04	73
Notes and Attendance	High Risk	Group Leader	100%	2024/03/04	73
Record of assigned tasks etc.	High Risk	Group Leader	100%	2024/03/04	73
Group Task 3: Topology Network design	Goal		100%	2024/04/11	26
Complete network designs for rooms on Packet Tracer.	Milestone	All Teams	100%	2024/04/11	6
Send Packet Tracer files to	Low Risk	All Teams	100%	2024/04/17	1


Group Task 2: Continuous Reporting Goal 100% 2024/03/04 73
Notes and Attendance High Risk Group Leader 100% 2024/03/04 73
Record of assigned tasks etc. High Risk Group Leader 100% 2024/03/04 73
Group Task 3: Topology Network design Goal 100% 2024/04/11 26
Complete network designs for rooms on Packet Tracer. Milestone All Teams 100% 2024/04/11 6
Send Packet Tracer files to Team 3 Low Risk All Teams 100% 2024/04/17 1
Compile and test packet tracer files Milestone Team 3 mainly 100% 2024/04/18 3
Describe network topology design Milestone Team 3 mainly 100% 2024/04/21 2
Finalization of relevant documentations Milestone Team 3, Group Leader 100% 2024/04/23 3
Group Task 4: Text Messaging Application Goal 100% 2024/05/07 9
Research and Tests On Track Selected Developers 100% 2024/04/11 12
Group Task 2: Continuous Reporting Goal 100% 2024/03/04 73
Notes and Attendance High Risk Group Leader 100% 2024/03/04 73
Record of assigned tasks etc. High Risk Group Leader 100% 2024/03/04 73
Group Task 3: Topology design Network Goal 100% 2024/04/11 26
Complete network designs for rooms on Packet Tracer. Milestone All Teams 100% 2024/04/11 6
Send Packet Tracer files to Team 3 Low Risk All Teams 100% 2024/04/17 1
Compile and test packet tracer files Milestone Team 3 mainly 100% 2024/04/18 3
Describe network topology design Milestone Team 3 mainly 100% 2024/04/21 2
Finalization of relevant documentations Milestone Team 3, Group Leade 100% 2024/04/23 3
Group Task 4: Text Messaging Application Goal 100% 2024/05/07 9
Research and Tests On Track Selected Developers 100% 2024/04/11 12
Design Application On Track Selected Developers 100% 2024/04/23 6


Tracer
Send Packet Tracer files to Team 3
Low Risk
All Teams
100%
2024/04/17
1
Compile and test packet tracer files
Milestone
Team 3 mainly
100%
2024/04/18
3
Describe network topology design
Milestone
Team 3 mainly
100%
2024/04/21
2
Finalization of relevant documentations
Milestone
Team 3, Group Leade
100%
2024/04/23
3
Group Task 4: Test Messaging Application
Goal
100%
2024/05/07
9
Research and Tests
On Track
Selected Developers
100%
2024/04/11
12
Design Application
On Track
Selected Developers
100%
2024/04/23
6
Test concept
On Track
Selected Developers
100%
2024/04/29
2
Assign Front, Back, Back/ Front-End roles to members and start
Milestone
All Members
100%
2024/05/01
3
Merge the Front-and Back End files
Milestone
Selected Developers
100%
2024/05/04
2
Test the application
Milestone
Back/ Front-End Dev
100%
2024/05/06
1
Finalize application and optimize
Milestone
Back End Dev
100%
2024/05/07
3
Double check
High Risk
All members
100%
2024/05/10
3



Group Task 3: Topological Network Design

Report:

Overview of problem:
(Discuss possible issues that need to be addressed. Also focus on work-from-home aspects):

This assignment entailed the design of a comprehensive network infrastructure for a single-story detached property spanning approximately 100 x 50 metres. The network that has to be designed must cater to the needs of various staff members, each expected to connect between 1 to 4 Wi-Fi devices, that are all considered untrustworthy.

There are 13 offices, accommodating 2 to 4 individual employees each, they must have a total of 4 wired access points each. The network must also make provision for 2 to 4 devices that should be able to connect to the Wi-Fi, for each employee in these offices. The technicians' office, serving 2 technicians, necessitates 2 wired access points for them, as well as direct connectivity to the machine room, and Wi-Fi support for up to 8 devices per technician. In the reception area 2 wired access points, designated for 2 personnel, are needed along with full Wi-Fi coverage and access to a networked printer. The kitchen requires 4 wired access points for IoT devices and Wi-Fi connectivity for the staff.

The meeting room has to accommodate 20 to 30 individuals and should be equipped for teleconferencing, 2 wired access points should be provided are essential for the communication devices alongside the Wi-Fi access for the staff. The machine room, which is exclusively accessed by technicians, houses the servers, the routers, and the bigger switches (switches with more than 8 ports) for the entire building; it also serves as a termination point for the ISP fibre line. The network in the open floor space should be able to provide connectivity for 75 to 120 employees; this means that it should also provide 100 wired access points, Wi-Fi access for each staff member. There are also 5 networked printers positioned adjacent to the machine room.

The overall goal of this network to be designed is to ensure a seamless connectivity, optimal bandwidth allocation, and effective device management across the entire property.

The network should also be able to allow certain employees to work from home, and wirelessly connect to the business network environment. For the network to be able to support this functionality, one needs to address a few potential issues, for example the bandwidth allocation, to ensure the network can handle the demands of both the in-house staff, and the remote workers simultaneously without sacrificing performance or security. The Network also needs to provide remote accessibility, which means to provide secure remote access to the network, whether that be through a VPN Solution or Multi-factor authentication.

With this in mind, the network should be designed to facilitate seamless communication, collaboration, and productivity among all the employees across the entire organisation.

Describe network topology designed:
(Discuss selection of routers, switches, repeaters, etc. and motivate the selection of each):

The network topology we designed is a combination of several different topologies, benefiting from the advantages of these different generic topologies. Our Network design contains a central node, which in this case is two multilayer switches, to which all the other device in the network connect to. We decided that only switches should be able to physically connect to the main multilayer switches, as this makes the device management as well as the device and network allocation easier. We added a second switch to our design, that increases redundancy, but reduces the chances of an error, or a failure in the network, influencing the working of and the connectivity of the other devices in the network. Each of these 9 switches connected to the main multi layered switches then connected to the individual devices in each of their designated areas with their own cable. This ensures that even if the network cable for a specific computer/ section breaks or is damaged, the other devices are unaffected, and can still continue to work as normal.

We have selected switches for the central node due to their ability to manage traffic efficiently, prevent data collisions, and provide high-speed connectivity to all connected devices. They offer better performance and scalability compared to hubs, making them ideal for this scenario. Ethernet cables were chosen to connect the devices in the network for their reliability and affordability. They provide a stable physical connection between the devices and the central switch, ensuring consistent data transmission within the network between the connected devices. A router was selected to be used in the network, to connect this network to other external networks, such as the internet. They handle the routing of data between different networks, providing the network with access to resources beyond the local network.

Budget and Relevant specifications:

- Addendum A contains a detailed budget for each room as well as a description of the rooms.
- *When including VoIP devices

Devices:

Device	Type	Quantity	Cost
TP-LINK TL-SF1024	Switch	8	R7 992
D-Link DAP-1360	Indoor Access Point	10	R3 700
TP-LINK TL-SF1008D	Switch	3	R 690
5-Port Gigabit Ethernet Unmanaged Linksys switch, 1000Mbps	Switch	2	R1 080
TP-Link EAP610 Ultra-Slim Wireless Access Point	Wireless Access Point	3	R 4 680
Ooma Telo VoIP*	VoIP*	2*	R2 600*
TP-Link T1700G-28TQ	Multilayer switch	2	R14 200
TP-Link Archer AX6000	Router	1	R 5 500
1 TP-Link Omada	Wireless LAN Controller	1	R2 000
TOTAL*			R42 442*
TOTAL			**R39 842**

Labour Costs(Installation and setup):

Room	Service (of all devices)	Quantity	Total cost with contingency of 20%
"13 Offices" (1 storage and 12 offices)	Installation and setup	1	R3 500
Technician's Office	-	1	R 2 200
Reception/ Waiting Area	-	1	R5 000
Kitchen	-	1	R3 900
Meeting Room*	-*	1*	R4 600*
-	-	1	R3 900
Machine Room/ Server Room	-	1	R62 400
Open Floor Space	-	1	R3 500
TOTAL*			**R85 100***
TOTAL			**R84 400**

Sections	Cost	Cost*
Devices	R39 842	R42 442*
Labour costs	R84 400	R85 100*
Total	**R124 242**	**R127 542***

The total budget can be calculated with a 10% margin to accommodate for any unseen expenditure. Total budget = **R137 000** (Rounded up) and if VoIP needed = **R141 000** (Rounded up) *.

How users would connect remotely:
(Which remote software should be used, and why (include choices in the budget);
Security implications (e.g. vulnerability to lateral movement);
Bring Your Own Device considerations; and Establishment of a cooperative virtual workspace):

For the remote employees to be able to connect remotely to the business network environment, certain aspects and issues should be taken into consideration. These issues should include which remote access software to use, the security implications of having all the network's resources available over the internet. It should also be considered how the business's network will accommodate Bring Your Own Device and the policies to protect the business and employees in this situation, and how the business will create a cooperative virtual workspace between its employees.

When the business selects a software to use for the remote employees to connect to the business network, the options include VPN's (Virtual Private Network)'s, Cisco AnyConnect or even simpler Remote Desktop Protocols such as Microsoft Remote Desktop, or even collaboration software platforms like Microsoft Teams or Slack. We would recommend a VPN Software to establish a secure connection between the remote users and the corporate network, ensuring data privacy and integrity during the transmission of data, but still allowing the user to have access to all the resources on or connected to the network.

Giving employees remote access to the network and its resources, introduces great security risks, particularly vulnerability to lateral movement in the network, this is when the attacker gains unauthorised access to one device in the network, and then attempts to move laterally through the

network. But these risks can be combated through implementing strong authentication methods such as multi-factor authentication (MFA). Another control that can be implemented is network segmentation which only allows employees access to controls that they require for their role in the business.

If the business implements a Bring Your Own Device practice, certain BYOD policies should be established to govern the use of personal devices for remote work. These policies should outline security requirements such as mandatory device encryption, specific antivirus software and regular security updates. Another control that can be implemented is Device registration and enrolment. This process can ensure that only authorised devices are allowed to connect to the corporate network remotely, greatly reducing the risk of security threats.

If the business allows employees to remotely connect to the business network, certain actions can be taken to create a cooperative virtual workspace between the different employees. For example, collaboration platforms such as Microsoft Teams, Slack or even Google Workspace can enable remote users to collaborate effectively through messaging, video conferencing, file sharing, and project management tools. Even further, the business can establish shared document repositories and project management dashboard within these platforms to promote transparency, accountability and even teamwork among remote users.

Evaluate the designed network:

- Does it fulfil the requirements?
  - This network design is mainly based on a star topology, but not completely and is rather a combination of more than one generic network topology.
  - This design does fulfil all the specified requirements for this business environment situation that is described in the project.

- What is good about this setup?
  - This topology is inherently scalable, allowing easy expansion of the network, and the devices connected to it. Expansion of the network can easily be done by just adding more devices to the central switches, without disrupting any existing connections.
  - Since each device in the network communicates directly with the central switch, it recovers the overall data collision and latency in the network, ensuring efficient performance.
  - This topology isolates an issue, if one should occur, since for example if one device or cable fails, it typically does not affect the rest of the network, as each device is connected independently to the central switch.
  - Since two switches are used in parallel with one another, if one switch fails, there's still a backup switch and all the network activities can continue as normal. This also reduces the chances of the network becoming overloaded.

- What is problematic about this setup?
  - The devices in this setup must be located within the reach of the Ethernet cables or Wi-Fi signals, which could potentially limit mobility and flexibility within the building, in terms of network design.
  - Since two multilayer switches are used, it increases the cost of the network hardware by a lot and can quickly make the business network setup extremely expensive.

- Which part of the network is likely to need the most maintenance? Can this part of network be installed in a way that facilitates maintenance?
    - The open floor space, with its 100 wired access points, is the most likely to require the most maintenance due to the sheer number of connections and potential for cable wear or damage.
    - Installing these access points in a modular and accessible manner can facilitate maintenance tasks. To facilitate maintenance in the open floor space, structured cabling systems should be implemented, allowing for easy identification and replacement of cables if needed.
    - Additionally, the organizing of access points in zones or clusters can simplify troubleshooting and maintenance efforts, reducing downtime and disruptions to users in this network.

- Which parts, if any, would remain if the company moves to a virtual office environment completely? Why?
    - In a completely virtual office environment, certain parts of the network would remain very essential and needed for the network to function such as:

        1. **Machine Room/Server Room:**
           The servers and networking equipment housed in the machine room would remain critical for hosting centralised data and services accessed remotely by employees.
        2. **Remote Access Infrastructure:**
           Components supporting remote access, such as VPN servers or remote desktop services, would still be necessary to facilitate connectivity for remote workers.
        3. **Security Measures:**
           Network security measures, including firewalls, intrusion detection systems, and access controls, would remain vital to protect the organisation's digital assets, even in a virtual office environment.

While certain components of the network would still be essential in a virtual office scenario, the physical infrastructure requirements may be reduced, this means that there is less emphasis on wired connections and more reliance on remote access technologies.

Creating the subnet for the network:

The subnet 192.168.0.0/22 spans from 192.168.0.0 to 192.168.3.255. Here are the detailed ranges broken down within this subnet:

1. **192.168.0.0/24**
    - Network Address: 192.168.0.0
    - First Usable IP: 192.168.0.1
    - Last Usable IP: 192.168.0.254
    - Broadcast Address: 192.168.0.255

2. **192.168.1.0/24**
    - Network Address: 192.168.1.0
    - First Usable IP: 192.168.1.1
    - Last Usable IP: 192.168.1.254
    - Broadcast Address: 192.168.1.255

3. **192.168.2.0/24**
    - Network Address: 192.168.2.0
    - First Usable IP: 192.168.2.1
    - Last Usable IP: 192.168.2.254
    - Broadcast Address: 192.168.2.255

4. **192.168.3.0/24**
    - Network Address: 192.168.3.0
    - First Usable IP: 192.168.3.1
    - Last Usable IP: 192.168.3.254
    - Broadcast Address: 192.168.3.255

Summary of Usable IP Address Ranges

- 192.168.0.1 - 192.168.0.254
- 192.168.1.1 - 192.168.1.254
- 192.168.2.1 - 192.168.2.254
- 192.168.3.1 - 192.168.3.254

These four /24 subnets collectively provide 1024 addresses, with 1008 usable addresses (excluding network and broadcast addresses for each /24 subnet).
This meets the requirement of providing enough addresses for 1000 devices.

Issues encountered :

- **Group Conflicts:**
    - No conflicts existed, some misunderstandings but was quickly resolved.
- **Scheduling Problems:**
    - Everyone was able to attend meetings. With one exception being a family event and/ or other important event occurring on same time and day.
- **Technical challenges:**
    - Basic training was given, but not very helpful in aiding us in completing these tasks.

In conclusion, very few issues occurred in the group as everyone was cooperative and willing to help where they can.

How the group managed the project without face-to-face meetings:

- Advantages:
    - Flexible in terms of arranging a meeting anytime via digital communication channels (e.g. Discord).
    - Most of the members were more productive when working alone than working sitting in groups and working together.
    - Communication was effective as WhatsApp was used as well as calling one another to assure what work needs to be done etc.
    - Digital channels benefits communicating information with each other whenever the university had to close. (e.g. water crises, protests etc.)
    - Saves money (e.g. transportation costs etc.)
    - Convenient
- Disadvantages:

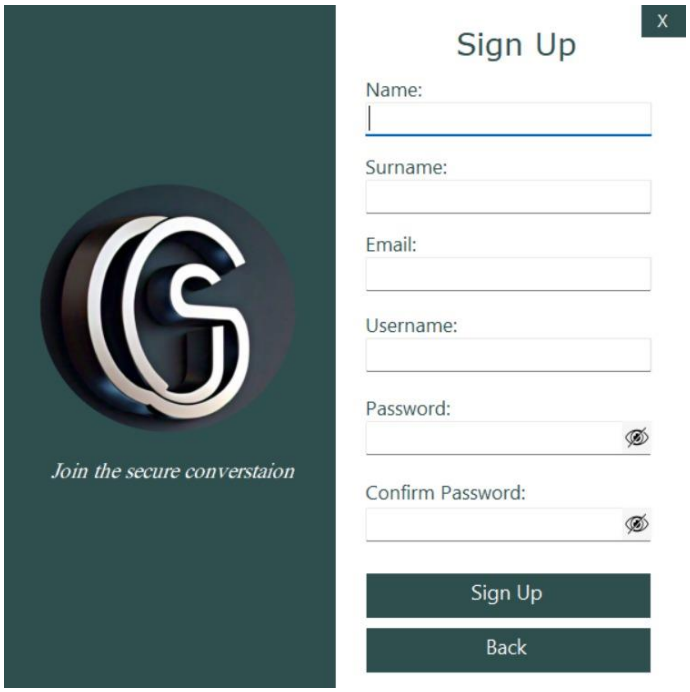
  - Chance of miscommunication/ misunderstandings between members existing.
  - Partial understanding of the work of the tasks.
  - Lack of knowledge when using software for online meetings (?)
  - Losing track of time.
  - Technical issues that could prohibit one from attending a meeting/ doing work or communicating effectively.
- Lessons learned from this exercise.
  - Managing people.
  - Work-From-Home skills.
  - Managing time effectively.
  - Clear communication is key.
  - Learned using GitHub for collaboration.

Group Task 4: Text Messaging App Development

Manual For End-Users on how to use the text application:

Sign Up:

If you do not have an account at ChatSphere Messenger yet, you must first sign up. Choose the sign-up option (Sign Up) and enter your name, surname, email address, username, and password. You will be notified if any of the provided inputs are invalid, already exists or 'confirm password' does not match the desired password. Upon successful registration, you may proceed by clicking on the login button (Login) to access your account.

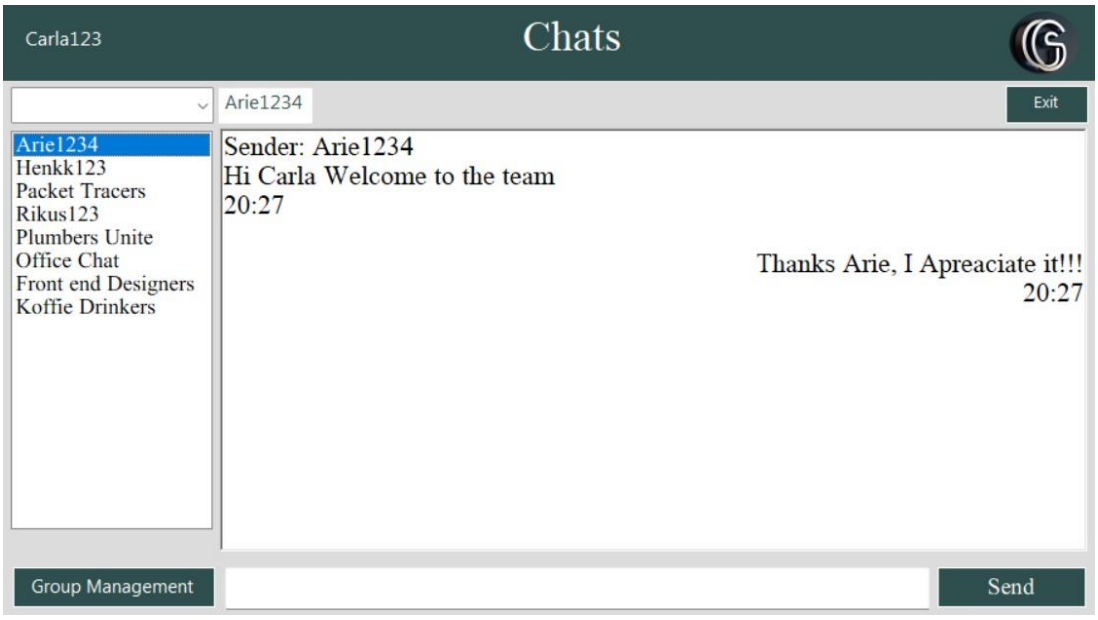


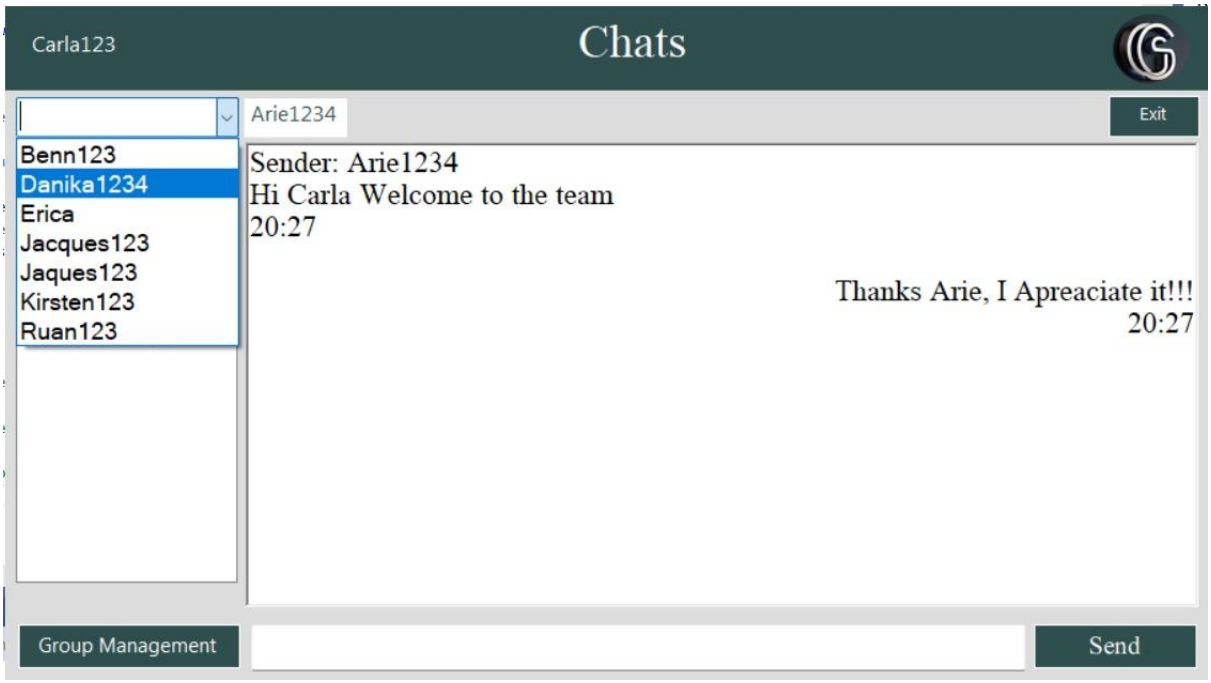
Login:

The login screen will prompt you to insert the username and password that you have previously created. Upon correct entry, you will be directed to the messaging screen. You will be notified if the username or password is invalid.

Layout of messaging screen:

At the top left of the screen, your username will be displayed. Directly below, is a search bar, that displays all the contacts you have not yet engaged with. Beneath the search bar lies a comprehensive list of all ongoing chats. Adjacent to the search bar, on the right-hand side, you will find the username of the individual with whom you are currently engaged in conversation with. You can type a message to that contact in the text bar at the bottom of the screen. Press the button to the right of it to send (Send). Positioned at the bottom left of the screen is a button that manages groups (Group Management). You can exit a chat by clicking the top right button (Exit).





Group management screen.

At the left of the screen is a list of all the groups you are the admin of. When you click on the group, you can change the description, as well as add and remove members from the group. Click the bottom right button to create a new group. After you have changed the data of a group or created a new group, remember to save (Save Changes).

Packet Tracer Reflection:

We utilized the given specifications to create the network topology.

The different sections were clearly defined, and we allocated the appropriate devices accordingly. To ensure the devices that are going to use this network can connect smoothly, we determined that a central multilayer switch should be used for the smaller switches to connect to. We added a second multilayer switch for redundancy and robustness, to ensure we minimise potential risks and downtime the network might encounter. We used VLAN to separate the network logically, we then assigned a DHCP pool to each VLAN for the wired and wireless devices.
Static IPs were assigned to the devices in the server room such as the multilayer switches, a server, a router, WLC (Wireless Lan Controller) and the pc that manages it.

This design approach allowed us to establish a scalable and easily manageable network infrastructure. We encountered a challenge regarding the one fibre connection to the Internet. As the project specifications did not provide a specific method, we needed to find a suitable solution and we decided that using a web server to represent the internet was the best.

Working with Cisco Packet Tracer provided us with a valuable learning experience. As a team, we were initially unfamiliar with the environment and had to acquire new network building skills. Through hands-on experimentation and research, we gained a deeper understanding of network design principles and device configurations. Overall, the project allowed us to apply theoretical knowledge to practical scenarios, enhancing our understanding of network design and troubleshooting. The challenges we encountered helped us develop problem-solving skills and adaptability and prepared us for future networking endeavours.

Initially for the packet tracer project we immediately took the wrong approach, the best way to describe it would be to say that we took a bottom-up design approach, where 2 people worked on a section of the network by themselves. After everyone completed their part, it was time to combine all the sections of the network and we immediately realised that there was communication involved between components such as allocating IPv4 addresses with the help of the DHCP protocol. And from there on the rubric stated to isolate the sections which can be done in various ways, but we opted for Inter-VLAN Routing.

Text Messaging Application Reflection:

Reflecting on the messaging application developed by our group, We are truly impressed by the valuable insights and expertise we acquired throughout the entire process. The project not only expanded our proficiency in various C# methods and features but also deepened our understanding of establishing connections between different machines using their respective IP addresses and ports. Overcoming challenges emerged as an integral part of our journey, notably tackling the intricacies of connecting and enabling seamless communication between devices.

Additionally, configuring the Peer-to-Peer server proved to be a significant hurdle, as we discovered the need to address message routing concerns that could potentially cause confusion when engaged in conversations with multiple users. Ultimately, the experience fostered tremendous personal and professional growth, equipping each team member with a wealth of new knowledge and skills to carry forward.

For the text-messaging app I made 2 rough ideas about how we could approach the chat app's way of communicating. Further along the road we made use of a web server called firebase which eased things. The code from my previous 2 ideas were used in the final ChatSphere text-messaging app.

Group's Experience with project:

When we reflect on our group's journey through this project, it's evident to us that we embarked on a journey that required both technical and collaborative skills. Initially we were focused on constructing a robust network design using Cisco Packet Tracer, this task required us to plan meticulously and pay close attention to detail. Each member of the groups contributed their expertise and opinions to the distinct sections of the network design, so that we as a group could allocate appropriate devices and could ensure that the network, we are designing can ensure smooth connectivity to its users.

We also had to create a text messaging application using C# and Google's Firebase Database. This aspect of the project required us to design a user interface, create a Data management schema, and also use real-time communication functionalities. Despite never working with this technology before and facing big hurdles the group's collective determination and problem-solving skills propelled us forward, to complete the project at hand, and do a rather great job at it.

Looking back on these Group Tasks after we have finished them, we can see that we established a roadmap for collaboration, and it is clear to us that our group's dynamic played a vital role in our success. Because we had regular communication, and division of tasks based on our individual strengths and interests, we excelled in completing this project.

Overall, when we think about this project, we can see that it was both challenging but also very rewarding. We as a group gained valuable insights into network infrastructure design and developments. We all learned a lot about software and real-time communication app development. We as a group excelled in this project and we are very happy with what we achieved.

Addendum A:

13 Offices:

Thirteen offices are constructed, with twelve allocated for 2 - 4 staff members each and one designated for storage. Four wired access points will be available in each office, as well as Wi-Fi for staff members through the use of wireless access points.

Two 24-Port switches, located in the machine room, will be used to provide 4 wired access points to each office. Four wireless access points will be used to provide a Wi-Fi connection to staff, with two located in the machine room and two placed closer to the applicable offices which are further away from the machine room.

Devices and Costs:

For the wired access points, 2 TP-LINK TL-SF1024 switches will be used that are located in the machine room. These switches have 24 ports each, meaning that only two units are required to provide for all twelve offices.

For the Wi-Fi connection, 4 D-Link DAP-1360 Indoor Access Points will be installed which would allow staff to connect to the internet. Each unit costs R 370 and is easy to set up and install, which will also lower labour costs.

Labour Costs

- Installation of 4 D-Link DAP-1360 Indoor Access Points:
  - Labour costs including contingency of 20%: R 3 500

Budget:

- Devices:
  - 4 D-Link DAP-1360: R 1 480
  - **Total:** **R 1 480**

- Labour Costs:
  - 4 D-Link DAP-1360: R 3 500
  - **Total:** **R 3 500**

- Total Cost: **R 4 980**

Therefore, a budget of **R 5 000** will be sufficient for the 13 offices.

Technicians' Office:

The technicians' Office does not form part of the 13 offices in terms of requirements, skill of user and job descriptions of employees. Two technicians would be situated in the office where they would make use of desktops or laptops that would ideally have ethernet ports. Two wired access points would be provided and dedicated to office work. Additionally, four wired access points should be available for potential office equipment maintenance. Direct wired access to the Machine Room will also be provided. Wi-fi for 16 devices should be made available (8 devices per technician).

The technicians' office consists of two technicians using a desktop each. There is a wired switch (that has seven ports) that connects directly to the machine room. The switch also connects to the technicians' desktops and four desktops representing the potential office equipment when in maintenance. There is also a wired access point for the technicians where 16 devices can connect to the Wi-Fi.

Labour Costs:

- Installation of 1 D-Link DAP-1360 Indoor Access Points:
  - Labour costs including contingency of 20%: R 700
- Installation of 1 TP-LINK TL-SF1008D:
  - Labour costs including contingency of 20%: R 1 500

Budget:

- Devices:
  - 1 D-Link DAP-1360: R 370
  - 1 TP-Link TL-SF1008D: R 230
  - **Total:** **R 600**

- Labour Costs:
  - 1 D-Link DAP-1360: R 700
  - 1 TP-Link TL-SF1008D: R 1 500
  - **Total:** **R 2 200**

- Total Cost: **R 2 800**

Therefore, a budget of **R 3 000** will be sufficient for the Technicians Office.

Reception/ Waiting area:

The reception/waiting area accommodates two staff members and multiple guests. For the staff, two wired access points are available, as well as full Wi-Fi access for up to 4 devices per staff member. Limited Wi-Fi is provided for guests and the room has one networked printer.

The room will have 1 5-Port switch to connect the devices to the rest of the network, as well as provide a wired access point to each staff member respectively. For the Wi-Fi, two access points will be installed to provide staff members and guests with a reliable Wi-Fi signal.

Devices and Costs:

A TP-LINK TL-SF1008D switch will be installed to connect this room and its components to the rest of the network, as well as provide two wired access points to staff members. Only one unit needs to be purchased, costing R 230.

For the Wi-Fi connection, two D-Link DAP-1360 Indoor Access Points will be installed.One access point will provide for the staff Wi-Fi connection and the other for the guest Wi-Fi connection. Costing only R 370 per unit, this is a much better option financially compared to many other access points.

Labour Costs:

- Wi-Fi for Staff and Guests:
  - Labour costs including contingency of 20%: R 3 500
- Switch Installation and Setup:
  - Labour costs including contingency of 20%: R 1 500

Budget:

- Devices:
  - 2 D-Link DAP-1360: R 740
  - 1 TP-LINK TL-SF1008D: R 230
  - **Total:** **R 970**

- Labour Costs:
  - Wi-Fi for Staff and Guests: R 3 500
  - Switch Installation and Setup: R 1 500
  - **Total:** **R 5 000**

- Total cost: **R 5 970**

Therefore, a budget of **R 6 000** will be sufficient for the Reception/Waiting Area.

Kitchen:

The kitchen, located next to the reception, has 4 wired access points for 'Internet of Things' devices, such as a smart fridge, lights, coffee machine and a smoke detector. Wi-Fi will also be available.

A 5-port Switch will be used as a wired access point for the IoT. The kitchen will also have an wireless access point to supply a strong Wi-Fi signal.

Devices and Costs:

One Linksys 5-port switch will be installed, which will cost R540. A TP-Link wireless access point will be used for Wi-Fi, costing R1560.

The total cost of the devices amounts to **R 2 100**.

Labour Costs:

- Wi-Fi for staff:
  - Labour costs including contingency of 20%: R 2 400
- Switch installation and setup:
  - Labour costs including contingency of 20%: R 1 500

Budget:

- Devices:
  - 1 5-Port Gigabit Ethernet Unmanaged Linksys switch, 1000Mbps: R 540
  - 1 TP-Link EAP610 Ultra-Slim Wireless Access Point: R 1 560
  - **Total:** **R 2 100**
- Labour Costs:
  - Switch installation and setup: R 1 500
  - Wi-Fi for Staff: R 2 400
  - **Total:** **R 3 900**
- Total cost: **R 6 000**

Therefore, a budget of **R 6 500** will be sufficient for the Kitchen.

Meeting Room:

The meeting room/board room can accommodate 20 to 30 people. There are 2 wired devices, Voice over Internet Protocol (VoIP), used for teleconferencing. There is also Wi-Fi available for 250 devices to connect to.

2 VoIP teleconferencing devices will be connected to a 5-port switch, which will be connected to the rest of the network. 2 Wireless access points allows all the people to connect up to 4 devices to the Wi-Fi.

Devices and Costs:

Two Ooma Telo VoIP devices will cost R2600, but it is an optional add-on. A Linksys 5-port switch to be installed is priced at R540. Lastly, 2 TP-Link wireless access points will cost R 3 120.

The total cost of the devices amounts to **R 6 260** including the 2 VoIP devices. Excluding the VoIP devices, the total cost will be **R 3 660.**

Labour Costs:

- Wi-Fi for staff:
  - Labour costs including contingency of 20%: R 2 400
- Switch installation and setup:
  - Labour costs including contingency of 20%: R 1 500
- Setup and installation for teleconferencing hardware (Optional):
  - Labour costs including contingency of 20%: R 700

Budget:

- Devices:
  - 2 Ooma Telo VoIP: R 2 600
  - 1 5-Port Gigabit Ethernet Unmanaged Linksys switch, 1000Mbps: R 540
  - 2 TP-Link EAP610 Ultra-Slim Wireless Access Points: R 3 120
  - **Total including VoIP devices: R 6 260**
    - **Total excluding VoIP devices: R 3 660**

- Labour Costs:
  - Switch installation and setup: R 1 500
  - Wi-Fi for Staff: R 2 400
  - Setup and installation for teleconferencing hardware: R 700
  - **Total including VoIP devices: R 4 600**
    - **Total excluding VoIP devices: R 3 900**

Total cost including VoIP devices: **R 10 860**
Total cost excluding VoIP devices: **R 7 560**

Therefore, a budget of **R 11 000** will be sufficient for the Meeting room/Boardroom when the optional add-on (VoIP devices) is included. If it is not included, a budget of **R 8 000** will suffice.

Machine Room/ Server Room:

The machine room houses most of the switches which connect components from different rooms to one another. Only technicians are allowed within the room. Servers within the machine room are accessed primarily from the technicians office. All of the Internet traffic moves through the machine room to the rest of the network, but not all the traffic moves through the servers. No Wi-Fi connection is necessary within the machine room itself.

Two multilayer switches will be installed in the machine room. One of the switches is connected to a router (connected to the Internet), and connects the multiple 24-port switches going to each room respectively. The other multilayer switch provides an internet connection of all the access points used in the building, and is connected to the wireless LAN controller.

Eight 24-Port Switches will be used to provide for the 100 wired access points in the open floor space, and the wired access points in the 12 offices.

Devices and Costs:

Two TP-Link T1700G-28TQ multiplayer switches will be installed. These switches contain 24 ports each and provide Gigabit ethernet. Each unit costs R 7 100.

For the Internet connection, the TP-Link Archer AX6000 will be used. This router costs R 5 500 and uses Gigabit ethernet to provide an Internet connection to the connected devices.

A TP-Link Omada wireless LAN controller will be installed costing R 2 000.

Eight TP-Link TL-SF1024 switches will be purchased with each unit costing R 999, amounting to a sum of R 7 992. These switches each contain 24 ports, making it the most power efficient and budget-friendly option.

Labour Costs:

- 2 TP-Link T1700G-28TQ Setup and Install:
  - Labour costs including contingency of 20%: R 21 000
- TP-Link Archer AX6000 Setup and Install:
  - Labour costs including contingency of 20%: R 5 400
- TP-Link Omada Setup and Install:
  - Labour costs including contingency of 20%: R 1 000
- 8 TP-Link TL-SF1024 Setup and Install:
  - Labour costs including contingency of 20%: R 35 000

Budget:

- Devices:

  - 2 TP-Link T1700G-28TQ: R 14 200
  - 1 TP-Link Archer AX6000: R 5 500
  - 1 TP-Link Omada: R 2 000
  - 8 TP-Link TL-SF1024: R 7 992
  - **Total:** **R 29 692**

- Labour Costs:

2 TP-Link T1700G-28TQ Setup and Install	R 21 000
TP-Link Archer AX6000 Setup and Install	R 5 400
TP-Link Omada Setup and Install	R 1 000
8 TP-Link TL-SF1024 Setup and Install:	R 35 000
Total:	**R 62 400**

- Total cost: **R 92 092**

Therefore, a budget of **R 100 000** will be sufficient for the Machine Room.

Open Floor Space:

The open floor space is described as a multi-functional office space that needs to be adaptable to accommodate various tasks and projects. The room is big enough to accommodate 75 – 120 people and the floor is raised to allow cables to effortlessly run under the desks to the machine room. One hundred wired access points are available to allow for devices to connect to the network via Ethernet. Staff have a reliable Wi-Fi connection and five networked printers are available.

The room's devices will be connected to 5 24-Port switches, located in the machine room, which is connected to one main multilayer switch. Five printers will be connected to one 8-Port switch, making them accessible to the rest of the network. Three access points will be connected to a multilayer switch in the machine room to provide a Wi-Fi connection to staff members.

Devices and Costs:

A TP-LINK TL-SF1008D switch will be used to connect the 5 printers to the rest of the network. Costing only R 230, this switch has 8 ports and provides a data transfer speed of 100Mbps to all its connected components.

Three D-Link DAP-1360 Indoor Access Points will be used to provide a stable Wi-Fi connection to staff. With a cost of only R 370 per unit, these access points are both affordable and high quality, making it the perfect choice.

Labour Costs:

- Wi-Fi for Staff:
  - Labour cost including contingency of 20%: R 3 500

Budget:

- Devices:
  - 1 TP-LINK TL-SF1008D: R 230
  - o 3 D-Link DAP-1360 Indoor Access Points: R 1 110
  - **Total:** **R 1 340**
- Labour costs:
  - Wi-Fi for Staff R 3 500
  - **Total:** **R 3 500**
- Total cost: **R 4 840**

Therefore, a budget of **R 5 000** will be sufficient for the Open Floor Space.