



Project Proposal

Network Performance Evaluation of Linux Based Operating Systems in a Physical Environment

Date: 02/04/2025

Version: 1.6

Client: Dr. Raymond Lutui

Prepared By:

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Changelog

Date	Version	Author	Note
13/03/2025	0.1	Nathan	Initial document creation.
15/03/2025	1.0	Nathan	Initial versioning and header.
17/03/2025	1.01	Nathan, Zafar	Formatting, basic information for early sections, and some placeholders.
18/03/2025	1.02	Thomas	Update date and name.
20/03/2025	1.03	Zafar, Win	Formatting, start of methodology comparison, new team member, disclaimer, and start of references.
24/03/2025	1.04	Zafar	Addition of methodology information and references.
25/03/2025	1.05	Nathan	Formatting and addition of cost information.
26/03/2025	1.1	Thomas, Nathan, Win	Reformatting of document sections, terms of reference, and upskilling information.
27/03/2025	1.2	Nathan, Win, Zafar	Reformatting sections into paragraphs, documents added to appendix, additions and changes to methodology, and summarising some sections with reference to appendices.
28/03/2025	1.3	Nathan, Thomas	Formatting and placeholders for missing information. Version bumped to 1.2 with properly written changelog (should be 1.3 – fixed next day).
30/03/2025	1.4	All Team Members	Completion of draft proposal with revisions of all major sections.
31/03/2025	1.5	All Team Members	Improvement based off feedback, reformatting document and layout.
02/04/2025	1.6	All Team Members	Continued improvement based off feedback, and further reformatting.

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Executive Summary

This project evaluates the IPv4 and IPv6 network performance of three Linux-based software routers using iPerf/D-ITG. Performance evaluation, encompassing throughput, delay, jitter, and packet loss, will be conducted across 12 packet sizes on a network comprised of four computers.

The project, estimated at 300-360 hours, acknowledges potential risks such as Linux networking experience and hardware limitations, and includes a cost analysis for mentor support and necessary equipment.

Some of the risks and constraints to put into consideration would include lack of team experience with Linux networking, possible hardware failure, and potential budget restraints.

The total project cost is budgeted at NZD\$125,721.31, which covers the hardware, labour, and tools needed for the project.

Terms of Reference

Our client, Dr. Raymond Lutui, has requested an evaluation of the network performance of three Linux-based operating systems (Fedora, Ubuntu, and Kali Linux) configured as software routers, to determine which has the best performance and to compare the data with his previous evaluations. Despite IPv4's acknowledged scalability constraints and IPv6's intended role as a replacement (Suryaningrat et al., 2016), a lack of real-world performance data hinders network professionals from confidently strategising and executing the migration to IPv6 in their software-defined networks (Narayan et al., 2016).

This project addresses the lack of real-world data with thorough network evaluation: measuring throughput, delay, jitter, and packet loss across 12 different packet sizes using iPerf and D-ITG, over both IPv4 and IPv6, in a four-PC network topology. The project is estimated to take 300-360 hours, commencing on April 4, 2025, with final deliverables due on October 31, 2025.

Rationale

The transition to IPv6, while crucial for internet expansion and advanced features, introduces increased data overhead. This can create performance bottlenecks, particularly in resource-constrained software routers. To address this, we will conduct a controlled experiment measuring the performance differences between IPv4 and IPv6. Using TCP and UDP protocols across 12 packet sizes on four Linux systems configured as software routers. We will evaluate on 3 different Linux operating systems which include, Ubuntu, Fedora, and Kali. We will analyse throughput, delay, jitter, and packet loss. The resulting empirical data will provide valuable insights for network performance comparing IPv4 to IPv6.

Project Objectives

The goal of this project is to evaluate the performance of 3 latest Linux based Operating Systems distributions – Fedora, Ubuntu, Kali Linux. These operating systems need to be configured as software routers before running the evaluations. Tools such as iPerf or D-ITG are to be employed to generate the evaluation traffics.

Objectives to be achieved include:

- Setup a network with 4 computers, 2 clients and 2 servers (servers configured as routers)
- Use TCP and UDP as transmission protocols.
 - Evaluate on IPv4
 - Evaluate on IPv6
- Performance evaluation:

Commented [DV1]: Terms of reference should be one paragraph the client request the objective a problem and how the projects address the problem the methodology, the timeline. Don't need multiple headers for it.

Commented [DV2]: rationale is a statement or explanation that provides the reasoning behind a decision, action, proposal, or idea. It articulates the motivations, logic, and justification for something being proposed or undertaken. The rationale helps to ensure that stakeholders understand the importance and relevance of the decision and can include the following elements:

Purpose: Clarification of why the proposal or action is necessary or beneficial.

Context: Background information that situates the decision within a larger framework, such as current issues, challenges, or needs.

Justification: Evidence or arguments that support the proposed course of action, including data, research findings, or examples.

Expected Outcomes: A description of the anticipated benefits or effects that will result from the decision or action.

- Each evaluation should run a minimum of ten times.
 - Evaluate for throughputs.
 - Evaluate for any delays.
 - Evaluate for jitter.
 - Evaluate for any packet loss.
 - Any evaluation that falls outside the 95% confidence interval needs to be re-run
- Each evaluation will range from a minimum of 128 through to 1536 Bytes to assess performance under different conditions.
- Set up physical machines with Fedora, Ubuntu, and Kali Linux distributions configured as software routers.
- Conduct performance evaluations to evaluate network throughput, delay, jitters, and packet loss for TCP and UDP transmissions on IPv4 and IPv6 protocols.
- Follow the hybrid waterfall-scrum methodology for systematically evaluating phases and activities including requirement analysis, evaluation planning, evaluation execution and evaluation closer.

Project Scope

This project encompasses the comprehensive performance evaluation of three Linux-based operating systems (Fedora, Ubuntu, and Kali Linux) configured as software routers. The scope includes configuring and evaluating all three operating systems across a four-PC network topology (one sender, two routers, one receiver), with evaluation of both TCP and UDP protocols over IPv4 and IPv6. Performance assessments will measure throughput, delays, jitter, and packet loss across 12 different packet sizes ranging from 128 to 1536 bytes. Each configuration will undergo 10 evaluation runs to ensure statistical validity, with additional runs conducted for any results falling outside the 95% confidence interval. The project includes detailed analysis and documentation of all findings, complete data logging, and delivery of comparative performance statistics across all evaluated operating systems. For more complete details on the scope statement, please refer to Appendix B.

Out of Scope

This project focuses specifically on performance evaluation and does not include hardware procurement, initial operating system installation, nor physical environment setup.

The team will not be responsible for implementing performance improvements based on findings, providing ongoing maintenance, nor supporting the evaluation environment beyond the project duration.

Evaluation is limited to the specified operating systems, network topology, and protocols as outlined in the scope statement.

Key Stakeholders

The project client is Raymond Lutui, with Daniel Vaipulu acting as supervisor.

The project team consists of seven members: Kylie Afable, Zafar Azad, Larissa Goh, Nathan Quai Hoi, Charmi Patel, Win Phyo, and team lead Thomas Robinson.

For a complete and detailed list of stakeholders, please refer to Appendix C, and for the Stakeholder Management Plan, please refer to Appendix D.

Technical Infrastructure

The project would involve 4 computer hardware provided by the client, in which two will be configured as routers, while the other two will be used as sender and receiver. For a detailed representation of the technical infrastructure layout of the evaluation environment, please refer to Appendix E.

Skills Analysis

All team members have existing Linux and networking experience but will need to upskill in specific networking tools such as iPerf and D-ITG.

Some team members will need to upskill in certain Linux skill areas such as BASH scripting. Therefore, an upskilling plan schedule has been created. For a complete skills analysis matrix, please refer to Appendix F.

Upskilling Plan Schedule

After the proposal is submitted on Friday 4th April 2025, and assuming it is accepted at the proposal presentation during the following week, the team will have approximately two weeks of uninterrupted time for upskilling. During that time, it is expected that team members self-study using the resources provided below and help each other learn where someone has more knowledge on a required subject than others. For the complete upskilling plan schedule, please see Appendix G.

Deliverables

The project will deliver a comprehensive performance evaluation package including complete evaluation logs, statistical analysis of performance metrics, comparative analysis across all evaluated operating systems, and a final report detailing findings and methodology. All raw data and configuration documentation will be provided to enable verification and potential future analysis.

Success Criteria

The project will be considered successful upon delivery of valid performance data for all three operating systems, using both TCP and UDP protocols over IPv4 and IPv6, with all evaluation results falling within the 95% confidence interval. Success includes comprehensive documentation of methodology, complete raw data logs, and a final analysis comparing performance across all evaluated configurations.

Project Management Methodology

Methodology	Core Approach	Pros	Cons
Waterfall	A fixed set of phases, where each phase must be completed before moving to the next phase. (Atlassian, n.d.)	Waterfall outlines a clear project structure; this demonstrates clear cost and goals. Due to the fixed nature of the methodology, tracking is linear and easier. The upfront planning approach also minimises risk factors as most of them are accounted for in the initial planning phase. Waterfall approach also expects fewer delays that can occur from additional requirements. (Atlassian, n.d.)	Due to the fixed nature of the methodology, its benefit can also be a drawback depending on the nature of the project. Projects that require continual interactions with end users and the team to review current direction and course correction do not fit in the waterfall approach. Its fixed approach ultimately limits flexibility. (Atlassian, n.d.)
Scrum	Working quickly and collaboratively while promoting an environment that allows changes during the development cycle. (Asana, 2025)	The scrum framework is the suggested approach for software development projects that prioritises customer needs constantly changing throughout the development lifecycle. The phases of this approach are broken down into sprints. Once a sprint is completed, review and feedback commence to improve the efficiency of the next sprint. (Asana, 2025)	Due to the agile approach being constantly changed and reviewed after each sprint, limitation on resource planning can occur due to the unclear end objective. In most cases, the dev team can only have sight on a few sprints ahead. Agile is also difficult to measure due to its nature of change which can also result in scope creep. (Asana, 2025)
Lean	A methodology that focuses on maximising efficiency by reducing waste and continually looking for workflow improvements. (The Digital Project Manager, n.d.)	Lean methodology is a subset of agile workflow, leans emphasise on reduction of waste in the product development phase. Lean project management requires continuous improvement to all development lifecycles. (The Digital Project Manager, n.d.)	The inverse of consistently focusing on reduction of waste can result in losing sight of the scope. This approach also is more reactive than proactive as waste reduction occurs as they are identified which can cause prediction of demands to be challenging. (The Digital Project Manager, n.d.)

The chosen methodology uses a hybrid Waterfall-Scrum approach because our project requires both structured documentation and iterative development. Waterfall is well-suited for the planning and execution phases, where we need clear documentation, risk management, and defined deliverables. This ensures that our project remains well-organised and aligned with stakeholder expectations.

However, since our implementation and evaluation phases involve setting up and optimising multiple operating systems, Scrum allows us to work in sprints: configuring, evaluating, and refining each OS before moving to the next. Our phases are based on the Software Testing Life Cycle (STLC). These include the 6 key phases which our management methodology is applied to, the phase break down are as below. (Katalon, 2025).

Project Phases

1. Requirement Analysis Phase

- Project initiation, project scope, objectives, and deliverables
- Team contract, project charter
- Work Breakdown Structure (WBS)

2. Evaluation Planning

- Define evaluation data, scenarios and environment
- Resource planning
- Training requirements.

3. Evaluation Case Development

- Approved evaluation plan.
- Defined evaluation case scenarios.
- Validate with client.

4. Evaluation Environment Setup

- Establish Hardware and Software
- Prepare Evaluation Data
- Configure Evaluation Environment

5. Evaluation Execution phase

- All evaluations are performed, and results are documented
- Implement evaluation case failure protocol
- Analyse Performance Metrics to determine Operating System Performance

6. Evaluation Close

- Prepare an excel spreadsheet of all the data for each operating system.
- Document Closure Report
- Client Feedback

Deliverables

For project-related documents, please refer to the scope statement in Appendix B.

The product-related deliverables include:

- Results of the evaluation for each Linux OS in a spreadsheet.
- Logs for the evaluation
- Results comparison document

Team Contract

This section covers all the team members and the assigned roles. For complete details on team contract, please refer to Appendix H.

Member Name	Team Role	Assigned IP Version
Thomas Robinson	Project Manager	IPv4
Win Phyto	System Architect	IPv4
Zafar Afrad	Network Engineer	IPv4
Kylie Afable	Network Engineer	IPv6

Larissa Goh	Network Engineer	IPv6
Nathan Quai Hoi	System Architect	IPv6
Charmi Patel	Network Engineer	IPv6

Each Team members are responsible for allocating 12 – 15 hours per week as weekly commitment for the project. All team members are to complete the assigned tasks on timely manner, while constantly communicating with the team while adhering to the code of conduct and ethic.

Team Schedule

The table below shows the frequency along with the time, date, location for our meetings.

Time	Monday	Tuesday	Wednesday	Thursday	Friday
11am					
12pm				Team Meeting	
1pm				Weekly Meeting with Mentor / Client	
2pm				R&D Workshop	
3pm					
4pm	Team Meeting (if needed)				
5pm					
6pm					
7pm		Team Meeting			
8pm					
Time	Monday	Tuesday	Wednesday	Thursday	Friday
11am					
12pm				Team Meeting	
1pm				Client/Mentor Meeting (Fortnightly)	
2pm				R&D Workshop	
3pm					
4pm	Team Meeting (if needed)				
5pm					
6pm					
7pm		Team Meeting			
8pm					

Commented [DV3]: Use this as an example

Commented [DV4]: This is how you setup a team weekly schedule

All the meeting minutes and agendas are attached in Appendix I.

Risk Register

Risks are identified during planning and reviewed weekly during team meetings. Team members raise or are assigned risks, assess their causes and potential impact of each, and define suitable mitigation strategies. If a risk occurs, it's escalated to the Issue Log where it's tracked separately and monitored until it's closed. Refer to Appendix J & K for the complete Risk Register and Risk Management Plan. Below are two scope-related risks that have the potential to impact the project if not managed.

Risk	Description	Mitigation
Tool replacement due to compatibility issues	One of the client's chosen tools D-ITG, has shown compatibility issues as it is not available in the Fedora package repositories and cannot be compiled from source. This creates a risk of inconsistent data as Fedora will lack D-ITG metrics that will be captured on Ubuntu and Kali.	The team will conduct additional evaluations with D-ITG on Fedora to determine feasibility. If it remains non-functional, iPerf will be used to maintain consistency across all operating systems. This will be documented and communicated to stakeholders to stay within the scope.
Incorrect router configuration affecting evaluation results	The project requires the configuration of Ubuntu, Fedora, and Kali as routers. Since routing directly affects packet flow, any error from misconfiguring routing tables or IP forwarding can compromise result accuracy.	The team will follow best practices for Linux router setups and validate configurations during the analysis phase. A checklist will be used for consistency, and a peer review process will ensure each router is configured correctly.

Issue Log

Issues are logged when risks manifest or when unexpected problems arise during the project. Each issue is assigned to a team member for resolution and tracked until resolved. The issue log is also reviewed during weekly meetings, and priority is escalated where needed to prevent impact on project delivery. Refer to Appendix L For the complete Issue Log.

Project Plan

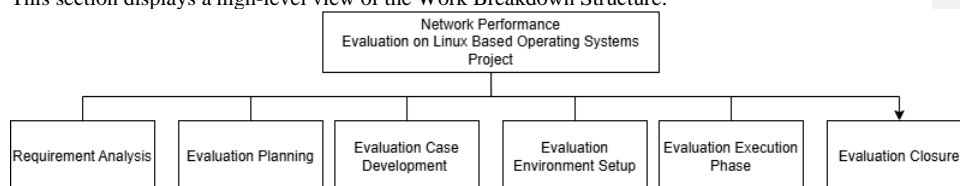
Milestones

This section includes the main milestones of the project, as well as internal milestones to help track the progress of the project, and meeting deadlines. The following table includes the important external milestones. For the complete Milestones Report, please refer to Appendix M.

Date	Milestone Type	Milestone
04/04/2025	External	Project Proposal Submission
06/06/2025	External	Mid-Term Review
17/08/2025	Internal	Completion of Ubuntu Evaluation
14/09/2025	Internal	Completion of Fedora Evaluation
12/10/2025	Internal	Completion of Kali Evaluation
31/10/2025	External	Final Poster
31/10/2025	Internal	Portfolio

WBS, Tasking, Scheduling

This section displays a high-level view of the Work Breakdown Structure.



For the complete and detailed version of the WBS and Gantt Chart, please refer to the Appendix N and O, respectively.

Estimated Costs

The table below shows the estimated cost of the project. For a complete and detailed breakdown of the cost, please refer to the section Labour Breakdown and Appendix P.

Cost Category	Description	Total Cost (NZD)
Hardware	Computers, Monitors, Laptops, Mouse and Keyboards	\$16,152.16
Labour	Mentor, Project Manager, System Architect, and Network Engineer average salary	\$109,420.80
Network Equipment	Network Cards, Ethernet Cable	\$148.35
Software Tools	IPerf, D-ITG	\$0
Total Estimated Cost		\$125,721.31

Labour Breakdown

We have included a full breakdown of labour costs for this project in Appendix Q. It covers each role needed in the project, including a mentor, project manager, network engineers, and system architects, along with how many hours they will contribute and the associated costs. Based on current industry rates (sourced from PayScale, 2025), the total cost for labour sums up to **NZD\$ 109,420.80**.

Project Feasibility

Required Infrastructure:

Equipment:

We will need 4 computers where 2 will act as routers while the other 2 will be the sender and receiver. Each router should have network cards to configure IPv4 and IPv6.

Tools and Technology:

Software:

Three Linux-based operating systems will be used, configured as routers. These operating systems are commonly used for networking tasks. We will be using Ubuntu, Fedora, and Kali Linux.

Network Performance Evaluation tools:

The tool 'iPerf' will be used to measure network performance. IPv4 and IPv6 will be evaluated using TCP and UDP transmission protocols. 12 variations of packet sizes will be used: 128, 256, 384, 512, 640, 768, 896, 1024, 1152, 1280, 1408, and 1536 Bytes.

Skills That Are Required:

- Familiarise themselves with Linux, software routing, and performance evaluation.
- Understanding IPv4 and IPv6 network principles.
- Adequate knowledge in programming languages.
- Problem solving with debugging and troubleshooting.
- Understanding how to configure routers and is comprehends the results from the network performance tools.

Roles:

Project Manager:

Looks after the project and ensures everyone and the project are all running smoothly.

System Architect:

Creates the general framework and ensures that it aligns with the projects main goal.

Development Team Member:

Builds, configures and maintains the network.

Rationale/Justification:

Our project aims to evaluate the performance of IPv4 and IPv6 protocols in different Linux based operating systems. This is done by using the routers for network configuration. With these tools, technologies, and required infrastructure, it helps us understand how both these protocols perform in different networking environments. This is important as IPv6 is on the rise.

Please refer to Project Purpose and Rationale.

Appendices

Appendix A – Disclaimer

Auckland University of Technology
Bachelor of Computer & Information Sciences

Research & Development Project

Disclaimer: Network Performance Evaluation on Linux Based Operating Systems

Clients should note the general basis upon which the Auckland University of Technology undertakes its student projects on behalf of external sponsors:

While all due care and diligence will be expected to be taken by the students, (acting in software development, research or other IT professional capacities), and the Auckland University of Technology, and student efforts will be supervised by experienced AUT lecturers, it must be recognised that these projects are undertaken in the course of student instruction. There is therefore no guarantee that students will succeed in their efforts.

This inherently means that the client assumes a degree of risk. This is part of an arrangement, which is intended to be of mutual benefit. On completion of the project, it is hoped that the client will receive a professionally documented and soundly constructed working software application, some part thereof, or other appropriate set of IT artefacts, while the students are exposed to live external environments and problems, in a realistic project and customer context.

In consequence of the above, the students, acting in their assigned professional capacities and the Auckland University of Technology, disclaim responsibility and offer no warranty in respect of the “technology solution” or services delivered, (e.g. a “software application” and its associated documentation), both in relation to their use and results from their use.

Appendix B – Scope Statement

Project Title: Network Performance Evaluation on Linux Based Operating Systems	
Date: 30/03/2025	Prepared by: Win Phyo & Thomas Robinson
Project Justification <p>This project is designed to evaluate the network performance of IPv4 and IPv6 on the latest versions of three popular Linux-based operating systems, so that the client may compare the data with historical data to observe changes in performance over time and between operating systems.</p> <p>Both IPv4 and IPv6 have their own benefits and drawbacks, of which this project intends to evaluate.</p> <p>With this data, the client can have a better understanding and comparison of how each of the chosen operating systems handles network traffic, which ultimately helps to make adequate decisions on optimising network infrastructure.</p>	
Product Characteristics and Requirements Functional Requirements: <ul style="list-style-type: none"> R1: Configure Fedora, Ubuntu, and Kali Linux as software routers R2: Implement both TCP and UDP transmission protocols R3: Support both IPv4 and IPv6 addressing R4: Set up a four-PC network topology (1 sender, 2 routers, 1 receiver) R5: Configure dual NICs on router PCs and single NICs on sender/receiver PCs R6: Perform three complete evaluation rounds, one for each operating system R7: Generate network traffic using iPerf or D-ITG R8: Evaluate with 12 specified packet sizes (128 to 1536 Bytes) R9: Run each evaluation configuration at least 10 times R10: Identify and re-run evaluations falling outside 95% confidence interval R11: Record throughput performance across all evaluation scenarios R12: All evaluations must be run 10 times each with all evaluations at 95% confidence R13: Record throughput performance across all evaluation scenarios R14: Measure network delays in all evaluation configurations R15: Calculate jitter values throughout evaluations R16: Track packet loss rates for all evaluation cases R17: Log all evaluations R18: Generate statistical averages using the evaluation tool R19: Compile final statistical data for comparison and analysis Non-Functional Requirements: <ul style="list-style-type: none"> R1: Results must fall within a 95% confidence interval R2: Statistical validation of evaluation results R3: Consistent evaluation methodology across all platforms and evaluation rounds R4: Evaluation environment must support the full range of packet sizes R5: Network infrastructure must handle required throughput levels R6: Measurement tools must be precise enough to capture microsecond-level jitter R7: Evaluation environment must maintain consistent conditions across evaluation rounds R8: Hardware configurations must remain stable throughout all evaluations R9: Evaluation tools must produce repeatable results R10: Complete logs of all evaluation runs must be preserved 	

- R11:** Detailed recording of evaluation configurations and parameters
- R12:** Final deliverable must include both raw logs and statistical summaries
- R13:** Evaluation must be organised into three distinct rounds/sprints (one per OS)
- R14:** Consistent evaluation procedures must be followed across all sprints
- R15:** Comparison data must allow for direct analysis between operating systems

Out of Scope:

- R1:** Acquisition of the four PCs required for evaluation
- R2:** Physical installation and configuration of hardware
- R3:** Initial operating system installations
- R4:** Network facility and power supply
- R5:** Physical security of the evaluation environment
- R6:** Environmental controls of the evaluation facility
- R7:** Long-term maintenance of the evaluation environment
- R8:** Ongoing support for the configured systems
- R9:** Application of findings to production networks
- R10:** Performance optimisation recommendations beyond evaluation results
- R11:** Evaluation of operating systems beyond the specified three distributions
- R12:** Network configurations other than the specified topology
- R13:** Evaluation of protocols beyond TCP and UDP
- R14:** Performance evaluation at speeds exceeding gigabit Ethernet
- R15:** Addressing performance issues identified during evaluation
- R16:** Implementing changes to improve network performance
- R17:** Troubleshooting underlying hardware issues

Summary of Project Deliverables**Project management-related deliverables:**

- Meeting Agendas
- Meeting Minutes
- Project Charter
- Team Contract
- Stakeholder Register
- Stakeholder Management Strategy
- Scope Statement
- Project Proposal
- Risk Register
- Issue Log
- Communication Management Plan
- Work Breakdown Structure (WBS)
- Gantt Chart
- Critical Path Analysis
- Skills Analysis
- Upskilling Plan Schedule
- Estimated Cost Breakdown
- Milestone Report
- Lesson-Learned Report
- Mid-Term Review
- Final Product Presentation

Product-related deliverables:

- Complete evaluation plans detailing procedures for all configurations
- Configuration documentation for router setup on each operating system
- Scripts or configuration files used for evaluation
- Spreadsheet of performance evaluation results
- Raw evaluation logs from all execution runs (10 runs per configuration)
- Data analysis documentation with statistical validation

Project Success Criteria:

- Delivery of all specified project deliverables
- Statistical validity of all evaluation results
- Clear presentation of comparative performance across operating systems
- Adherence to project timeline and budget constraints
- Comprehensive documentation allowing for evaluation reproducibility

Appendix C – Stakeholder Register

Stakeholder Register for Network Performance Evaluation on Linux Based Operating Systems - Physical Environment Version: 1.0

Prepared by: Nathan Quai Hoi

Date: 11/03/2025

Name	Position	Internal /External	Project Role	Contact Information
Nathan Quai Hoi	Team Member	Internal	System Architect	wgk6332@autuni.ac.nz
Win Phyo	Team Member	Internal	System Architect	ddk8093@autuni.ac.nz
Zafar Azad	Team Member	Internal	Network Engineer	ftk8708@autuni.ac.nz
Thomas Robinson	Team Leader	Internal	Project Manager	cgr2690@autuni.ac.nz
Larissa Goh	Team Member	Internal	Network Engineer	xhm5236@autuni.ac.nz
Charmi Patel	Team Member	Internal	Network Engineer	fhv9735@autuni.ac.nz
Kylie Afable	Team Member	Internal	Network Engineer	cjq7738@autuni.ac.nz
Daniel Vaipulu	Project Mentor	Internal	Project Mentor	daniel.vaipulu@aut.ac.nz
Raymond Lutui	Client	Internal	Client	raymond.lutui@aut.ac.nz
Ramon Lewis	IT Support	Internal	IT Support	ramon.lewis@aut.ac.nz
Dr. Ramesh Lal	Lecturer	Internal	Lecturer	ramesh.lal@aut.ac.nz
Prof. Catherine Shi	Lecturer	Internal	Lecturer	catherine.shi@aut.ac.nz
Olivia Tang	Lecturer	Internal	Lecturer	olivia.tang@aut.ac.nz

Appendix D – Stakeholder Management Strategy

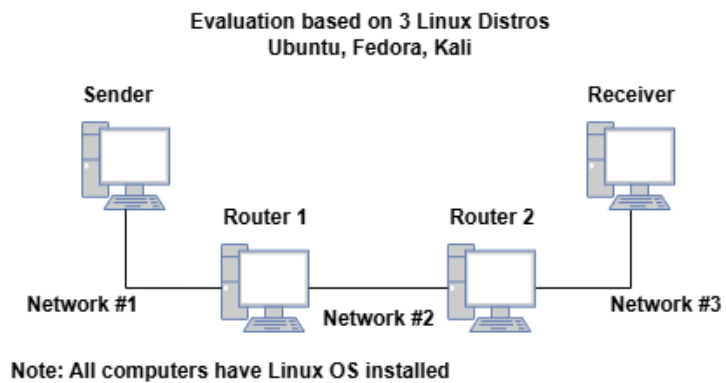
Stakeholder Management Strategy for Network Performance Evaluation on Linux Based Operating Systems

Prepared by: Nathan Quai Hoi

Date: 19/03/2025

Name	Level of Interest	Level of Influence	Potential Management Strategies
Daniel Vaipulu	High	High	Daniel is very resourceful and relaxed. He makes sure to engage the project at a reasonable pace. We will need to keep him updated with what is happening regularly.
Raymond Lutui	High	High	Raymond is very relaxed, while also having high expectations. We will need to keep him updated with what is happening.
Thomas Robinson	High	Medium	Thomas would like to ensure all team members are on the same page and keep track of the project tasks. He develops plans and allocates tasks to achieve goals.
Ramon Lewis	Low	High	Ramon would like to know details of our setup for evaluation and would like to communicate via Teams chat.

Appendix E – Network Diagram



The figure above shows the network diagram representing the technical infrastructure of the evaluation environment. Two computers will have the same Linux OS installed and configured as routers. A third computer will be the sender, and the fourth will be the receiver. There will be three different networks in total, and each computer will have its own static IP address.

Note: Router 1 and Router 2 computers will each have two Network Interface Cards.

Appendix F – Skills Analysis Matrix

Skills Matrix										
Team Members	Linux Installation and Configuration	Linux as Router Configuration	BASH Scripting	Subnetting IPv4	Subnetting IPv6	Understanding of Networking Protocols (TCP/UDP)	iPerf Usage	D-ITG Usage	Basic Network Performance Metrics (Throughput, Delay, Jitter, Packet Loss)	Basic Data Analysis Skills
Kylie Afable	2	0	2	1	1	1	0	0	0	0
Zafar Azad	2	0	0	3	1	3	0	0	2	1
Larissa Goh	2	0	0	1	0	1	0	0	1	1
Nathan Quai Hoi	2	0	1	2	1	1	0	0	0	0
Charmi Patel	2	0	0	1	0	1	0	0	0	1
Win Phyo	2	0	0	2	0	1	0	0	1	1
Thomas Robinson	3	0	2	2	1	2	0	0	1	2
Total	15	0	5	12	4	10	0	0	5	6
Average	2.14	0.00	0.71	1.71	0.57	1.43	0.00	0.00	0.71	0.86

Key			
0	1	2	3
Unskilled	Low-Skilled	Competent	Expert

Appendix G – Upskilling Plan Schedule

After the proposal is submitted on Friday 4th April 2025, and assuming it is accepted at the proposal presentation during the following week, the team will have approximately two weeks of uninterrupted time for upskilling. During that time, it is expected that team members self-study using the resources provided below and help each other learn where someone has more knowledge on a required subject than others.

General Resources:

Linux From Scratch: <https://www.linuxfromscratch.org/lfs/>

Build your own Linux distro to learn more about how Linux works.

Tangentially related to the project, time-consuming, but might be worth your time.

Linux Journey: <https://linuxjourney.com/>

Beginner guides and tutorials for Linux. A good free resource with which to start.

Arch Wiki: <https://wiki.archlinux.org/>

The Arch Linux wiki houses a ton of useful Linux information.

A lot of the information isn't Arch-specific and can easily be applied to other distros.

FreeCodeCamp: <https://www.freecodecamp.org/>

Contains tons of free tutorials from industry professionals. Videos and written guides on many subjects, including Linux and networking.

LinuxCommand.org: <https://linuxcommand.org/>

A guide to the Linux Command Line and shell scripts.

GNU/Linux Desktop Survival Guide: <https://www.togaware.com/linux/survivor/>

Tangentially related to the project but contains some good information if you want to use Linux as a regular operating system on your machine.

Linux as a router (Fedora): <https://fedoramagazine.org/use-fedora-server-create-router-gateway/>

A guide on configuring Fedora Server as a router gateway.

Physical Environment Team

Linux Network Performance Evaluation

Windows Users:

WSL: <https://learn.microsoft.com/en-us/windows/wsl/install>

Virtual machine package that runs Linux on and integrates into Windows.

WSL terminals can then be run to use Linux packages like a native OS.

Can be installed from the Windows Store for ease, and multiple distros can be installed at once.

Mac Users:

Homebrew: <https://brew.sh/>

Linux-like package manager that runs in Terminal and allows CLI (“Command Line”) packages such as iPerf or nmap to be installed easily.

Asahi Linux: <https://asahilinux.org/>

Dual-boot Linux support for Apple Silicon Macs. There are multiple distros to choose from, with the flagship being Fedora Asahi Remix, based on Fedora Linux.

Linux Distros:

Distros in bold are the focus operating systems for this project. However, it is worth researching their derivatives and upstream versions where applicable, as this may give you a better understanding of these Linux distros.

Fedora Linux: <https://fedoraproject.org/>

Fedora is effectively the unstable version of Red Hat Enterprise Linux (which is owned by IBM). It has become Red Hat's testbed and upstream distro in recent years. Works well for general users.

Uses the DNF package manager, which is considered slow but powerful.

Debian: <https://www.debian.org/>

A stable, point-release Linux distro often used for servers. Binaries and packages on Debian aren't usually the latest versions as a trade-off for stability.

Uses the APT ("Advanced Package Tool") package manager, which is used by many other distros.

Its versions are named after Toy Story characters.

Rocky Linux: <https://rockylinux.org/>

Based on Fedora and Red Hat Enterprise Linux; the spiritual successor to CentOS. Often used for servers and has long-term support.

Ubuntu: <https://ubuntu.com/>

Based on Debian Unstable (aka Debian Sid), Ubuntu is a popular distro for general use and great for beginners. It is also a commercialised distro – while it is free to use,

Ubuntu's parent company Canonical offers various upsells, especially for enterprise.

Red Hat Enterprise Linux: <https://www.redhat.com/en>

Also known as RHEL (pronounced "rall", as in "rally"), Red Hat Enterprise Linux has been the de-facto enterprise server OS for many years.

Red Hat was purchased by IBM, with both companies earning a controversial reputation over the years.

Red Hat Enterprise Linux is typically a paid-only Linux distro.

Despite all of this, you can make a free Red Hat account, earn industry-recognised Red Hat certifications, and even get a free individual subscription (i.e. not for commercial use) to use RHEL.

Kali Linux: <https://www.kali.org/>

Designed for penetration testing. Usually comes pre-installed with a lot of hacking tools, making it quick and easy to start penetration testing.

Based on Debian Testing, which is the stage between Debian Stable and Debian Unstable.

Tools:

Tools in bold are the focus of this project. However, D-ITG may cause problems (particularly on Fedora) because it is outdated by 8 years. Other tools are listed to give you points of comparison in terms of how networking tools work and when to use which tool.

iPerf: <https://iperf.fr/>

“iPerf3 is a tool for active measurements of the maximum achievable bandwidth on IP networks.”

Could be a good choice for the primary tool.

D-ITG: <https://github.com/jbucar/ditg>

“D-ITG is a platform capable to produce traffic at packet level accurately replicating appropriate stochastic processes for both IDT (Inter Departure Time) and PS (Packet Size) random variables.”

Nmap: <https://nmap.org/>

“Nmap ("Network Mapper") is a [free and open source](#) utility for network discovery and security auditing.”

qperf: <https://github.com/rbruenig/qperf>

“A performance measurement tool for [QUIC](#) similar to iPerf.”

Netperf: <https://hewlettpackard.github.io/netperf/>

“Netperf is a benchmark that can be used to measure the performance of many different types of networking. It provides tests for both unidirectional throughput, and end-to-end latency.”

Could be a good choice for the primary tool.

sockperf: <https://github.com/Mellanox/sockperf>

“sockperf is a network benchmarking utility over socket API that was designed for testing performance (latency and throughput) of high-performance systems.”

Could be a good choice for detailed latency and jitter analysis.

My Traceroute: <https://www.cloudflare.com/learning/network-layer/what-is-mtr/>

“My Traceroute, or MTR, combines traceroute and ping to measure a network path's health.”


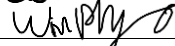
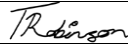


Wireshark: <https://www.wireshark.org/>

“The world's most popular network protocol analyser.”

Appendix H – Team Contract

Project Name: Network Performance Evaluation on Linux Based Operating Systems

Project Team Member Names and Sign-off:

Name	Date	Sign-off on Team Contract
Nathan Quai Hoi	18/03/2025	
Win Phyo	18/03/2025	
Zafar Azad	18/03/2025	ZA
Thomas Robinson	18/03/2025	
Larissa Goh	18/03/2025	
Charmi Patel	18/03/2025	
Kylie Afable	20/03/2025	KA

Code of Conduct: As a project team, we will:

- Work proactively, anticipating potential problems and working to prevent them
- Keep other team members informed of information related to the project
- Focus on what is best for the whole project team
- See the team project through to completion

Code of Ethics:

- Maintain integrity, transparency, and accountability in all actions.
- Respect and value diversity, fostering an inclusive team environment.
- Commit to excellence and collaborative efforts for project success.

Participation:

- Be honest and open during all project activities
- Encourage diversity in teamwork
- Provide the opportunity for equal participation
- Be open to new approaches and consider new ideas
- Have one discussion at a time
- Let the team know well in advance if a team member must miss a meeting or may have trouble meeting a deadline for a given task

Communication:

- Decide as a team on the best way to communicate various information
- Focus on solving problems, not blaming people
- Present ideas clearly and concisely

- Meet and communicate frequently to discuss project progress
 - Arrange additional meetings as needed
 - Keep discussions on track
 - Honor meeting timeframes
 - Read communications (emails, meeting minutes, action items, etc.) from each other
 - Respond to each other in a timely manner (i.e., within 24 hours)
-

Problem Solving:

- Encourage everyone to participate in solving problems
 - Only use constructive criticism
 - Hold each other accountable for meeting the standards
 - Consequences for behaviours impacting Team performance
-

Meeting Guidelines:

- It is mandatory to attend meetings every Thursday with the mentor/ client.
 - Any additional meeting date and time must be scheduled in advance.
 - Create and distribute an agenda before each meeting.
 - Set expectations for meeting schedules and respect allocated time for each agenda item.
 - Assign responsibilities for documenting meeting minutes, tracking action items, and following up on tasks between meetings.
 - Encourage feedback on meeting processes and suggest periodic reviews to assess the effectiveness of meetings and adjust guidelines as needed.
-

Consequences for behaviour impacting Team performance:

- Tasks will not be accomplished on time due to constant absence.
 - Poor communication among team members can impact work efficiency.
 - Project will not meet the deadline if individual tasks are not completed on time.
 - Teams cannot work effectively if team members do not respect other team members or constantly have conflicts.
-

Appendix I – Agenda and Meeting Minutes

Team Meeting (18/03/2025)

Client/Project:	Raymond Lutui - Network Performance Evaluation on Linux Based Operating Systems	
Purpose:	Kick-off Meeting with Team	
Meeting called by:	Thomas Robinson	
Location: Discord Call	Date: 18/03/2025	Time: 7:00 – 8:30pm
QA:	Version: 1.0	Minutes Reviewed By: Thomas

Meeting Attendees

Attendees	
Names	Representing
Nathan Quai Hoi	Project Member
Win Phyو	Project Member
Zafar Azad	Project Member
Larissa Goh	Project Member
Charmi Patel	Project Member
Thomas Robinson	Project Leader
Absent	
Names	Representing

MINUTES DETAILS

Minutes prepared by: Win Phyو	Minutes circulation to: Project Team
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Agenda

#	Agenda Item Description	Owner	Time Allotted
1.	Team Roles	Thomas	5 minutes
2.	Team Meeting Scheduling	Thomas	5 minutes
3.	Questions for Client Meeting – Brainstorm	Thomas	30 minutes
4.	Team Charter/ Contract	Thomas	5 minutes
5.	Team Portfolio Structure (Folders layout)	Thomas	5 minutes
6.	Project Task Allocation	Thomas	20 minutes

Open Action Items/Action Items from the Previous Meeting

#	Action Item Description	Owner	Expected Completion Date
1.			

Discussion and Decisions

#	Discussion and Decisions
1.	All team members agreed to have Thomas as Team leader for the project. The rest of the team members will decide on each role after figuring out the nature of the project.
2.	Zafar is trying to figure out the time allocation of each member for the project of (15 hours per week)
3.	All team members acknowledged Raymond as our client for both semesters (basically throughout the whole project). Plans to discuss contracts with Daniel (Mentor) and Raymond (Client).
4.	Figure out: What is it they want from the project? <ul style="list-style-type: none"> • Specific applications e.g. Web server, replace existing Uni server. • What hardware are we using? All three OS on same hardware or different? • Same SSD? Different PCIe generation? Different Brand? • Would the equipment be provided? • Running experiments on equipment at home? • Control variables? Different computers have different hardware... network cards... IPv6 <ul style="list-style-type: none"> • Not widely supported mostly yet, but worth evaluating.
5.	Need to pick a third OS Thomas (Fedora and Ubuntu are not the best choice) in favour of substituting others. (Not stable distros). <ul style="list-style-type: none"> • Fedora – unstable Red Hat • Ubuntu – unstable Debian Ask the client why or what reason is there for the two chosen OS distro.
6.	Thomas recommends: Debian, Rocky, and FreeBSD (not technically Linux but often used for this kind of application) as they are more stable and intended for long-term/server use.
7.	Discussion on each team members' experience with Linux Operating System: <ul style="list-style-type: none"> • Zafar – requires some upskilling (have experience with x86 from Operating System course and played around with penetrating tools in Kali. <ul style="list-style-type: none"> ◦ Questions pop up during meetings • Larissa – Beginner Linux (Hack the box, Try hack me) • Nathan – Kali, Ubuntu, configure Unifi Ubuntu machine, need to upskill <ul style="list-style-type: none"> ◦ Best to leave the third choice of OS until we know the reason behind the two chosen distros ◦ How does the client want updates: emails/meeting/etc. How often? • Charmi – Doing operating systems course this semester <ul style="list-style-type: none"> ◦ Agreed with what Nathan said. • Win Phyto – OS, installation of Linux Operating System. • Thomas – Experienced with Linux, uses Arch.
8.	Possible meeting time looking at all our schedules: Wednesday and Thursday Have not confirmed a fixed weekly meeting schedule for the team yet. Decided to have personal meetings when necessary.
9.	Linux From Scratch – good learning tool (for evidence of upskilling) recommendation from team leader.
10.	Look into Automating such as BASH scripting . Not all the procedures or steps. For loops in bash (easy) Since we need to have at least 10 evaluations.
11.	Everyone should familiarise themselves with Project Brief before Thursday Try to look at iPerf (for network performance evaluation) TCP and UDP All the networking basics and relevant information for the project
12.	Using Git for version controls on document Would require all team members to have git account and be invited into the git repository for access.

Summary of Action Items

#	Action Item Description	Owner	Expected Completion Date
1.	Team Portfolio Structure (Folders layout)	Thomas	19/03/2025
2.	Upskilling Recommendation List V1	Thomas	20/03/2025
3.	Team Contract V1	Win	20/03/2025
4.	Stakeholder management Strategy V1	Nathan	20/03/2025
5.	Stakeholder Register V1	Nathan	20/03/2025
6.	Communication Plan V1	Charmi	20/03/2025
7.	Gantt Chart V1	Nathan	20/03/2025
8.	Milestones report V1	Larissa	20/03/2025
9.	Work Breakdown structure V1	Win	20/03/2025
10.	Issue Log V1	Larissa	23/03/2025
11.	Risk Register v1	Larissa	23/03/2025
12.	Meeting Agenda for Client Meeting 20/03/2025	Zafar	19/03/2025

Next Meeting

Date: 20/03/2024		Time: After Client Meeting (11 AM)	
Discussion points for the next meeting:			
1.	Debrief after Client meeting		
2.	Review of Project Proposal		
3.	Project methodology and Approach?		
4.			
Action Items to be discussed in the next meeting:			
1.			
2.			
3.			

Mentor / Client Kick-Off Meeting Agenda (19/03/25)**Prepared by:** Zafar Azad**Date:** 19/03/25**Project Name:** Network Performance Evaluation on Linux Based Operating Systems**Meeting Objective:** Get the project off to an effective start by introducing key stakeholders, reviewing project goals, and discussing plans for future.**Agenda:**

- Introduction of attendees/stakeholders (team members, mentor, and client)
- Review of project background
- Review of project-related documents (e.g. business case, project charter)
- Discussion of project organisational structure and communication channels
- Discussion of project scope, time, cost and goals/objective
- Discussion of other important topics brought to attention
- List of action items from meeting

Action Items from kick-off team meeting to be discussed:

- Permission for and necessity of recorded meetings
- OS preference:
 - Why were Ubuntu and Fedora chosen?
 - Are these flexible?
 - Can the third choice be BSD-based (e.g. FreeBSD, NetBSD)?
- Clarification of required and provided hardware
- Costs involved
- IPv6 not widely supported – is it required?
- Current skills and upskilling

Action Item	Assigned To	Due Date

Date and time of next meeting:TBC; Pencil Thursday 27/03/25 @ 12pm (**Subject to change**)

Mentor / Client Meeting (20/03/2025)

Client/Project:	Raymond Lutui - Network Performance Evaluation on Linux Based Operating Systems	
Purpose:	Meeting with mentor / client to figure out what the project requires	
Meeting called by:	Thomas Robinson	
Location: WZ1101	Date: 20/03/2025	Time: 10am – 11 am
QA:	Version: 1.0	Minutes Reviewed By: Thomas

Meeting Attendees

Attendees	
<i>Names</i>	<i>Representing</i>
Thomas Hugh Robinson	Team Leader
Nathan Quai Hoi	Team Member
Win Phyo	Team Member
Zafar Azad	Team Member
Larissa Goh	Team Member
Charmi Patel	Team Member
Kylie Afable	Team Member
Daniel Vaipulu	Team Member
Raymond Lutui	Client
Absent	
<i>Names</i>	<i>Representing</i>

MINUTES DETAILS

Minutes prepared by: Nathan Quai Hoi	Minutes circulation to: All Team members
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Agenda

#	Agenda Item Description	Owner	Time Allotted
1.	Introduction to attendees/ stakeholders	Thomas	5 minutes
2.	Review of Project Background	Thomas	10 minutes
3.	Review of Project-related documents (Business case, Project Charter)	Thomas	5 minutes
4.	Discussion of project organisational structure and communication channel	Thomas	5 minutes
5.	Discussion of project scope, time, cost, and goals/ objective	Thomas	10 minutes
6.	Discussion of other important topics brought to attention	Thomas	5 minutes
7.	List of action items from meeting	Thomas	5 minutes

Open Action Items/Action Items from the Previous Meeting

#	Action Item Description	Owner	Expected Completion Date
1.			

Discussion and Decisions

#	Discussion and Decisions
1.	<p>Team member update: New Team member – Kylie Afable</p>
2.	<p>Project Overview – Set up Physical environment We will be provided with 4 computers 2 computers will have 2 network cards and will need to be configured as 2 routers.</p> <p>There will be three networks Network 1 – Sender to R1 Network 2 – R1 to R2 Network 3 – R2 to Receiver</p> <p>We were told to use Operating Systems similar to other groups which are: - Fedora, Ubuntu, Kali Linux</p> <p>Evaluating on IPv4 first on TCP and then UDP IPv4 Evaluation members: - Win Phyto, Zafar, Thomas</p> <p>IPv6 Evaluation members: - Larissa, Kylie, Nathan, Charmi</p> <p>Project First Execution Direction We will need to have a log file to submit as well as the evaluation results/ findings in excel file After evaluating IPv4, we will need to notify Mentor to meet with the client. If the client is satisfied with the results → we will continue onwards with IPv6 and carry out the results for another OS</p> <p>Note: We would need to take account for the specification of each hardware and equipment. The speed of the routers does matter in the performance evaluations.</p> <p>Note: We need to use the equipment given to carry out all the evaluations. They cannot be taken home.</p> <p>Note: Must use the tools specified for the network evaluation.</p>
3.	<p>Project Proposal, Methodology, Documents Mentor told us that we need to have project methodology set first Have a table of three project methodology and make a comparison between advantages and challenges of each. Write down the justification or reasoning behind the chosen methodology/approach. We may need to research SDLC (Software Development Life Cycle) A method/ approach where we need to go back to the previous phase to review/re-evaluate. MUST know the reason for choosing the approach. Note: Our Project does not require Business case.</p>
4.	<p>Team meeting schedules: We will have a weekly mentor/client meeting before the submission of the Project Proposal. After the Submission of Project Proposal, we will have a meeting with the mentor/ client every fortnight.</p>
5.	<p>Project Costs For estimate of project cost, we would need to account for all the costs on equipment, labour, and any expense incurred related to the project. They must be realistic too We need to have references on the costs with reliable sources.</p>
6.	<p>We were told to add Mentor and Client into Teams Group. The mentor will add the AUT IT tech guy, for us to communicate and find out more information on the specification of the hardware, and when we could use the equipment for evaluation.</p>

7.	Reminder of the project proposal due date on 4 th of April 23:59. Presentation the following week after the submission of the Project Proposal. The project Proposal should only be 10 pages, and any other documents should be attached in the Appendix.
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Summary of Action Items

#	Action Item Description	Owner	Expected Completion Date
13.			
14.			

For Summary of Action Items, please refer to the Team Meetings.

Next Client/ Mentor Meeting

Date: 27/03/2025 Thursday		Time: 10:00 AM	
Discussion points for the next meeting:			
1.	Project methodology		
2.	Project Proposal Update		
3.	Any questions regarding the project. Challenges?		
Action Items to be discussed in the next meeting:			
1.			
2.			

Team Meeting (20/03/2025)

Client/Project:	Raymond Lutui - Network Performance Evaluation on Linux Based Operating Systems	
Purpose:	Team meeting to recap client meeting and project task allocation	
Meeting called by:	Thomas Robinson	
Location: WZ701	Date: 20/03/2025	Time: 11 am– 12 pm
QA:	Version: 1.0	Minutes Reviewed By: Thomas

Meeting Attendees

Attendees	
Names	Representing
Thomas Robinson	Project Leader
Nathan Quai Hoi	Project Member
Win Phyoo	Project Member
Zafar Azad	Project Member
Larissa Goh	Project Member
Charmi Patel	Project Member
Kylie	Project Member
Absent	
Names	Representing

MINUTES DETAILS

Minutes prepared by: Win Phyoo	Minutes circulation to: Project Team
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Agenda

#	Agenda Item Description	Owner	Time Allotted
1.	Debrief on information from client meeting	Thomas	30 minutes
2.	Project proposal allocation	Thomas	10 minutes
3.			

Open Action Items/Action Items from the Previous Meeting

#	Action Item Description	Owner	Expected Completion Date
1.	Team Portfolio Structure (Folders layout)	Thomas	19/03/2025
2.	Upskilling Recommendation List V1	Thomas	20/03/2025
3.	Team Contract V1	Win	20/03/2025
4.	Stakeholder management Strategy V1	Nathan	20/03/2025
5.	Stakeholder Register V1	Nathan	20/03/2025
6.	Communication Plan V1	Charmi	20/03/2025
7.	Gantt Chart V1	Nathan	20/03/2025
8.	Milestones report V1	Larissa	20/03/2025
9.	Work Breakdown structure V1	Win	20/03/2025
10.	Issue Log V1	Larissa	23/03/2025
11.	Risk Register v1	Larissa	23/03/2025
12.	Meeting Agenda for Client meeting 20/03/2025	Zafar	19/03/2025

Discussion and Decisions

#	Discussion and Decisions
1.	Project Methodology – Agile + SDLC? Create a Table of three different methodology/approach with advantages and challenges... Choose the ideal methodology for our project and identify the phases.
2.	Project Proposal as our First milestone, which we plan to have all tasks completed by 31 st of March. This is a measure we place to ensure we have enough time to review, edit, and compile all documents.
3.	The team decided to allocate each task to at least two team members, to ensure all team members' participation in the project. Allocated Tasks to ensure the team meets the first milestone due on 4 th of April for our project proposal.
4.	The team plans to work on the presentation PowerPoint slide once the proposal has been completed.

Summary of Action Items

#	Action Item Description	Owner	Expected Completion Date
Project Proposal			
1.	Rationale	Thomas, Win Phyo	31/03/2025
2.	Objectives/ Scope	Thomas, Win Phyo	31/03/2025
3.	Skills Analysis	Charmi, Thomas	31/03/2025
4.	Team Schedule	Kylie, Win Phyo	31/03/2025
5.	Project Management / Methodology	Zafar and Thomas	31/03/2025
6.	Risk Registers	Larissa, Zafar	31/03/2025
7.	Issue Registers	Larissa, Zafar	31/03/2025
8.	Work Breakdown Structure	Win Phyo, Thomas/Zafar	31/03/2025
9.	Project Estimated Cost	Larissa, Charmi	31/03/2025
10.	Project Feasibility	Larissa, Kylie	31/03/2025
11.	Gantt Chart	Nathan, Win Phyo	31/03/2025
12.	Terms of Reference	Charmi, Kylie	31/03/2025

Next Meeting

Date: 27/03/2024		Time: Before Client Meeting (12 PM)	
<i>Discussion points for the next meeting:</i>			
4.	Project Proposal – Progress updates		
5.	Discussion on Assignment, questions		
6.			
7.			
<i>Action Items to be discussed in the next meeting:</i>			
3.			
4.			
5.			

Meeting Agenda (27/03/25)**Prepared by:** Thomas Robinson**Date:** 27/03/25**Project Name:** Network Performance Evaluation on Linux Based Operating Systems**Meeting Objective:**

Discuss progress towards initial proposal and work through any concerns/issues present before proposal is submitted.

Agenda:

- Roll call of attendees
- Review of open items (proposal progress)
- Raise issues and/or concerns
- Discussion of any other important topics brought to attention
- Discussion of any indirectly relevant (“parked”) items
- List of action items from meeting

Items to be raised:

- Clarification on methodology (AGILE chosen)
- D-ITG not available on Fedora repos; does not compile from source
- Team name (parked)

Action Item	Assigned To	Due Date
Complete proposal draft	All team members	30/03/2025

Date and time of next meeting:

TBC; Pencil Thursday 03/04/25 @ 1pm WZ1011

Mentor / Client Meeting (27/03/2025)

Client/Project:	Raymond Lutui - Network Performance Evaluation on Linux Based Operating Systems	
Purpose:	Meeting with Mentor/ Client for Project Update and review of Proposal	
Meeting called by:	Thomas Robinson	
Location: WZ1101	Date: 27/03/2025	Time: 1 pm – 2:00 pm
QA:	Version: 1.0	Minutes Reviewed By: Thomas

Meeting Attendees

Attendees	
Names	Representing
Thomas Hugh Robinson	Team Leader
Nathan Quai Hoi	Team Member
Win Phyo	Team Member
Zafar Azad	Team Member
Larissa Goh	Team Member
Charmi Patel	Team Member
Kylie Afable	Team Member
Daniel Vaipulu	Team Member
Absent	
Names	Representing
Raymond Lutui	Client

MINUTES DETAILS

Minutes prepared by: Win Phyo	Minutes circulation to: All Team members
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Agenda

#	Agenda Item Description	Owner	Time Allotted
1.	Roll call of attendees	Thomas	2 minutes
2.	Review of Open Items (Proposal progress)	Thomas	5 minutes
3.	Rate issues and/or concerns	Thomas	15 minutes
4.	Discussion of any important topics brought to attention	Thomas	15 minutes
5.	Discussion of any indirectly relevant (“parked”) items	Thomas	5 minutes
6.	List of actions items from meeting	Thomas	2 minutes

Open Action Items/Action Items from the Previous Meeting

#	Action Item Description	Owner	Expected Completion Date
1.			

Discussion and Decisions

#	Discussion and Decisions
1.	<p>Proposal Document</p> <ul style="list-style-type: none"> - Team needed to have version control table after the title page - Followed by Table of Contents - All sections need to be edited and formatted to have short paragraphs <p>Terms of Reference</p> <ul style="list-style-type: none"> - Start with the problem, followed by project purpose and opportunity. - The section for purpose should explain why the need for this project. <p>Objectives and Scope</p> <ul style="list-style-type: none"> - Copy and Paste from the project Brief, for the objectives. - structure it R1, R2 no bullet points - high level function requirements and non-functional requirements - deliverables: define where we will do the comparisons/clearly state e.g. on Excel - for more info on scope refer to appendix - list of things out of scope <p>Skill analysis</p> <ul style="list-style-type: none"> - Create a Skills Analysis matrix / table form - matrix = appendix / summarise and refer to appendix - plan for upskilling = key things to tackle
2.	The team needs to prepare the Client Contract and send it to Client for signature.
3.	<p>Project Management Methodology</p> <p>Must identify the roles based on the chosen methodology. All team members must be well-versed in the methodology, since moderators may ask any of the members for the reasons.</p> <p>Team Schedule</p> <p>Better to have the team schedule as a table format. The team needs to have a comparison between IPERF and DITG.</p> <p>Cost Breakdown</p> <p>Ensure that the team have a table for the section to have the summary of total cost in Proposal. The rest should be in the Appendixes, and make sure to have references of the sources for the prices.</p>
4.	Daniel suggested the team complete the first draft proposal by Sunday, for a thorough review and to provide feedback.
5.	Daniel said he will book the meeting for Thursday 3 rd of April 2025, at 1 PM for our meeting, to go through proposal document as well as have our mock presentation.
6.	The team should also message the IT senior Technician for the required hardware and equipment for the performance evaluation.

Summary of Action Items

#	Action Item Description	Owner	Expected Completion Date
1.			

Next Client/ Mentor Meeting

Date: 03/04/2025 Thursday	Time: 1:00 AM at WZ1101
<i>Discussion points for the next meeting:</i>	
1.	Proposal Document – Final Review
2.	Mock Presentation
<i>Action Items to be discussed in the next meeting:</i>	
1.	

Team Meeting (31/03/2025)

Client/Project:	Raymond Lutui - Network Performance Evaluation on Linux Based Operating Systems	
Purpose:	Discussion on proposal documents, feedback from mentor, upcoming presentation	
Meeting called by:	Thomas Robinson	
Location: Discord Call	Date: 31/03/2025	Time: 4:00 – 5:30 pm
QA:	Version: 1.0	Minutes Reviewed By: Thomas

Meeting Attendees

Attendees	
Names	Representing
Thomas Robinson	Project Leader
Nathan Quai Hoi	Project Member
Win Phyo	Project Member
Zafar Azad	Project Member
Larissa Goh	Project Member
Kylie	Project Member
Absent	
Names	Representing
Charmi Patel	Project Member

MINUTES DETAILS

Minutes prepared by: Win Phyo	Minutes circulation to: Project Team
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Agenda

#	Agenda Item Description	Owner	Time Allotted
1.	Roll call of attendees	Thomas	2 minutes
2.	Review of Open Items (Proposal progress)	Thomas	5 minutes
3.	Rate issues and/or concerns	Thomas	15 minutes
4.	Discussion of any important topics brought to attention	Thomas	15 minutes
5.	Discussion of any indirectly relevant (“parked”) items	Thomas	5 minutes
6.	List of actions items from meeting	Thomas	2 minutes

Open Action Items/Action Items from the Previous Meeting

#	Action Item Description	Owner	Expected Completion Date
Project Proposal			
1.	Rationale	Thomas, Win Phyo	31/03/2025
2.	Objectives/ Scope	Thomas, Win Phyo	31/03/2025
3.	Skills Analysis	Charmi, Thomas	31/03/2025
4.	Team Schedule	Kylie, Win Phyo	31/03/2025
5.	Project Management / Methodology	Zafar and Thomas	31/03/2025
6.	Risk Registers	Larissa, Zafar	31/03/2025
7.	Issue Registers	Larissa, Zafar	31/03/2025

8.	Work Breakdown Structure	Win Phyto, Thomas/Zafar	31/03/2025
9.	Project Estimated Cost	Larissa, Charmi	31/03/2025
10.	Project Feasibility	Larissa, Kylie	31/03/2025
11.	Gantt Chart	Nathan, Win Phyto	31/03/2025
12.	Terms of Reference	Charmi, Kylie	31/03/2025

Discussion and Decisions

#	Discussion and Decisions
1.	<p>Presentation PowerPoint slideshow Consideration for allocating Charmi and Kylie for creating the PowerPoint slideshow. Practise as a team once before mock-up on Thursday</p>
2.	<p>Finalised Project Methodology: Hybrid waterfall-scrum approach First two phases – Waterfall Scrum for the two phases with 3 sprints. Each sprint will be for each Linux OS.</p> <p>Concerns on if STLC is our project methodology itself or rather just a framework. Since client explicitly pointed out SDLC in the beginning of the projects.</p>
3.	<p>Project Proposal Document</p> <ul style="list-style-type: none"> Ensure all members change the version of the proposal document, as well as comment on the changes in version table. Need Milestone Report in the Appendix Create a Team Schedule for the proposal document <p>Terms of Reference: Need to be edited to be one paragraph, with the headers removed.</p> <p>Important Note: Prioritise on using “Evaluation” instead of “Testing”</p> <p>All Meeting Minutes and Agendas attached into appendix, most likely under the Team Schedule.</p> <p>Labour Breakdown Table to go into Appendix. Just have summary in the proposal document. One short paragraph. Better readability for the readers.</p> <p>Submission of Proposal Document on Friday, after final review from the whole team and improvement of feedback from the supervisor on Thursday. Team Leader will submit the Proposal document on behalf of the team.</p> <p>APA 7th References need to be in alphabetical order.</p>
4.	<p>Portfolio</p> <ul style="list-style-type: none"> 4 Gantt Chart files (best if it is only one file) May need Organising
5.	Client contract and Project Charter needs to be signed off.

Summary of Action Items

#	Action Item Description	Owner	Expected Completion Date
1.	Presentation PowerPoint	Charmi, Kylie	02/04/2025
2.	Terms of Reference	Thomas	02/04/2025
3.	Clarification on some Documents	Thomas	31/03/2025
4.	Milestone Report	Larissa	02/04/2025
5.	Meeting Minutes	Win Phyo	02/04/2025
6.	Rationale	Nathan	02/04/2025
7.	Project Methodology	Zafar	02/04/2025
8.	Labour Breakdown	Larissa	02/04/2025
9.	WBS	Win, Thomas	02/04/2025
10.	Completion of Proposal	All Members	04/04/2025
11.	Proposal Document Submission	Thomas	04/04/2025

Next Meeting

Date: 03/04/2025		Time: Before Client Meeting (12 PM)
<i>Discussion points for the next meeting:</i>		
1.	Mock-Presentation	
2.	Review of Proposal Document	
3.	Start of Analysis Phase	
<i>Action Items to be discussed in the next meeting:</i>		
1.		

Appendix J – Risk Register

Prepared by: Larissa Goh

Date: 19/03

No	Rank	Risk	Description	Category	Root Cause	Triggers	Mitigating Action	Risk Owner	Probability	Impact
1	Medium	Long distance between members	The huge distances between majority of the team may create challenges when organising meetups.	Logistical	Members located in different regions	Meetup planning, travel expenses, travel time, unreliable transport	Advanced weekly schedules in place, online meetings scheduled where needed	Project Manager	Medium	High
2	Medium	Varying levels of technical knowledge among members	All members have varying levels of technical skill required for this project. This disparity may create workload imbalances and affect team cohesion.	Training & Knowledge	Different backgrounds and technical experience	Imbalanced task completion. Reliance on members	Ongoing commitment to upskilling. Creating a skill matrix and detailed upskilling plan.	Team	High	High
3	High	Unsuitable operating system	Selecting an unsuitable operating system for our project. This may lead to major issues during our evaluation phase, cause compatibility issues, or have performance limitations.	Technical	Lack of research	software and hardware incompatibility	In depth research and assessing project requirements. Comparing OS options	System Architect	Medium	High

Physical Environment Team

Linux Network Performance Evaluation

4	High	Group member quitting	Group member potentially quitting during any stage of the project.	Team Members	Personal reasons	Personal reasons	Urgent meeting to discuss changed task delegations and effect on project timeline.	Project Manager	Medium	High
5	Low	Poor communication	Miscommunication or lack of clarity among group members	Team Members	Missed updates, unclear expectations, lack of structure	Low morale, unclear leadership, confusing task interpretation, failing to include others or themselves	Create a team contract, encourage communication, weekly high priority meetings that requires all members to share ideas and speak.	Project Manager	Low	High
6	Medium	File loss & Data corruption	Important data is lost or corrupted due to hardware issues or human error.	Data	Poor backup strategy, carelessness.	System crashes, storage issues, overwriting files	Implement regular backup on cloud or local drives. Use version control such as Git.	Network Engineer	Low	Medium
7	Medium	Sickness	Team member, mentor, and client may be unavailable due to sickness, especially going into colder months.	Health & Safety	COVID-19, infection	COVID and sickness increasing.	Enable remote collaboration is available when needed e.g. Discord, Teams. Flexibility to reschedule to suit client when needed.	Project Manager	High	Medium

Physical Environment Team

Linux Network Performance Evaluation

8	High	D-ITG Compatibility Issues	D-ITG may not function correctly or be supported on all selected operating systems.	Technical	Software incompatibility	Errors during installation	Early evaluation on each operating system	Network Engineer	High	Medium
9	High	Hardware Issues	Failure of critical hardware such as computers and network cards can delay evaluation.	Technical	Improper set up or handling, physical damage, firmware issues,	Loss of connectivity, overheating, inability to boot operating system	Perform early hardware evaluation, document all hardware used for quick replacement, spare equipment, in contact with IT technician	System Architect	Medium	High
10	Low	Incomplete evaluation due to time constraints	Large number of evaluation combinations may cause the team to run out of time.	Schedule	Time-consuming evaluation and set up	Delay in router configuration, tool issues	Ensure all tools and configurations are fully evaluated during analysis phase and divide responsibilities.	Project Manager	Low	High
11	Medium	Inconsistent evaluation results	Differing results between operating systems	Technical	Misconfigured routers, hardware issues	Differing results for identical evaluations	Standardise configuration steps, peer review setup.	System Architect	Medium	High
12	Low	Misinterpretation of data	Team may incorrectly analyse performance data due to unfamiliarity with tools, software, or hardware	Technical	Lack of network experience	Unexpected output formats, inconsistent logs	Research tool output structures, consult mentor if unclear, align on analysis methods as a team	Network Engineer	Low	Medium

Appendix K – Risk Management Plan

For our hybrid methodology combining Agile and Waterfall, risk and issue management are handled with both structured planning and continuous review. Risks are identified and documented during the planning phase through past experiences, client input, and technical research.

This involves reviewing:

- The project scope
- Objectives
- Timeline
- Tools
- Costs
- Team structure

However, as conditions change throughout a project, especially during the analysis and development phases, the team must be ready to adapt quickly. To manage this, risks will be monitored regularly and escalated to active issues if they occur.

1. Identify risk
2. Access risk
 - a. Likelihood
 - b. Impact
3. Record in risk register
4. Assign owner and plan mitigation
5. Monitor during weekly meetings

If a risk has occurred...

6. Move to issue log
7. Assign owner and track resolution
8. Resolve or escalate as needed
9. Continue monitoring risks

The team acknowledges that not all problems can be predicted. Unexpected problems that arise will be added directly into the Issue Log. This ensures both anticipated and unexpected challenges are managed effectively.

Appendix L – Issue Log

Prepared by: Larissa

Date: 19/03/2025

Issue #	Issue Description	Impact on Project	Date Reported	Reported By	Assigned To	Priority M/H/L	Due Date	Status	Comments
01	Delayed meeting with client and mentor	Delayed start on entirety of project as we need more information and details from our client.	17/03/25	Zafar	Group	H	NA	Closed	First meeting with client has been pushed to 20/03/25
02	D-ITG isn't available in Fedora repos; it won't be compiled from source	If the source code can't be fixed, another tool will have to be chosen for evaluation, despite the client's request.	25/03/25	Thomas	Thomas	H	27/03/25	Closed	Client isn't aware of this issue yet – it needs to be raised at 27/03 meeting
03	Cancelled team meeting	Due to multiple members facing unforeseen transport issues, our team meeting before our meeting with client and mentor had to be cancelled	27/03/25	Larissa	Thomas	H	29/03/25	Closed	Quick overview over Discord and in-depth debrief after to ensure everyone is on the same page
04	Management methodology didn't align with our project	Team roles and documentation process needed to be reviewed to indicate which protocol we will be following	27/03/35	Zafar	Group	H	29/03/25	Closed	A hybrid model approach has been selected to better suit the project

Appendix M – Milestone Report

Author: Larissa Goh

Date: 04/04/2025

Version: 1.0

Milestone	Date	Status	Responsible	Issues/Comments
Team Portfolio Structure (folder layout)	19/03/25	Completed	Thomas	Done on time
Project Schedule	25/03/25	Completed	Win	Done on time
Stakeholder Register V1	19/03/25	Completed	Nathan	Done on time
Team Contract	20/03/25	Completed	Win	Done on time
Upskilling Recommendation List V1	20/03/25	Completed	Thomas	Done on time
Skills Analysis	20/03/25	Completed	Thomas	Done on time
Stakeholder Management Strategy V1	19/03/2025	Completed	Nathan	Done on time
Stakeholder Register V1	20/03/25	Completed	Nathan	Done on time
Communication Plan V1	20/03/25	Completed	Charmi	Done on time
Gantt Chart V1	20/03/25	Completed	Nathan	Done on time
Milestone Report V1	02/04/25	Completed	Larissa	Done on time
Work Breakdown Structure V1	20/03/25	Completed	Win	Done on time
Network Diagram	31/03/25	Completed	Nathan	Done on time
Critical Path Analysis	31/03/25	Completed		Done on time
Issue Log V1	23/03/25	Completed	Larissa	Done on time
Risk Register V1	23/03/25	Completed	Larissa	Done on time
Meeting agenda for kick-off meeting	19/03/25	Completed	Zafar	Done on time
Meeting agenda for meeting #2	25/03/25	Completed	Thomas	Done on time
Meeting agenda for meeting #3	30/03/25	Completed	Thomas	Done on time
Meeting minutes for kick-off meeting	19/03/25	Completed	Win	Done on time

Meeting minutes for meeting #2	27/03/25	Completed	Win	Done on time
Meeting minutes for meeting #3	03/04/25	Completed	Win	Done on time
Estimated Costs Breakdown	31/03/25	Completed	Charmi	Done on time
Project Proposal Submission	04/04/25	Completed	Thomas	Done on time
Project Proposal Presentation	10/04/25	Pending	Team	

Appendix N – Work Breakdown Structure

Prepared By: Win Phyto & Thomas Robinson

Date: 02/04/2025

Project Name: Linux Network Performance Evaluation

1. Requirement Analysis (03/03/2025 – 04/04/2025)
 - 1.1. Entry Criteria
 - 1.1.1. Team Kick-Off Meeting Agenda
 - 1.1.2. Team-Client Kick-Off Meeting Agenda
 - 1.1.3. Team Contract
 - 1.1.4. Meeting Minutes (Kick-Off Meetings)
 - 1.2. Develop Project Proposal
 - 1.2.1. Stakeholder Register
 - 1.2.2. Project Charter
 - 1.2.3. Client Contract
 - 1.2.4. Meeting Minutes (Team & Client)
 - 1.3. Develop Project Plans
 - 1.3.1. Stakeholder Management Strategy
 - 1.3.2. Risk Register
 - 1.3.3. Issue Log
 - 1.3.4. Communications Management Plan
 - 1.3.5. Communications Management Plan
 - 1.3.6. Scope Statement
 - 1.3.7. Work Breakdown Structure
 - 1.3.8. Project Schedule
 - 1.3.8.1. Schedule baseline showing originally planned activities with their durations and milestones
 - 1.3.8.2. Network Diagram
 - 1.3.8.3. Critical Path Analysis
 - 1.3.9. Upskilling Plan
 - 1.3.10. Estimated Cost
 - 1.3.11. Milestone Report
 - 1.3.12. Project Proposal submission
 - 1.3.13. Project Proposal presentation
 - Milestone 1 – Project Proposal**
 - 1.4. Exit Criteria
 - 1.4.1. Client feedback on proposal document
 - 1.4.2. Approval of proposal document from client

2. Evaluation Planning (07/04/2025 – 06/06/2025)

- 2.1. Entry Criteria
 - 2.1.1. Client approval of project proposal
- 2.2. Researching And Upskilling
 - 2.2.1. Team members upskill for necessary skills
 - 2.2.2. Network tools (iPerf & D-ITG)
- 2.3. Define evaluation scenarios
- 2.4. Define evaluation environment
- 2.5. Exit Criteria
 - 2.5.1. Client and supervisor feedback on evaluation planning

Milestone 2 – Mid-Term Review

3. Evaluation Case Development (07/06/2025 – 20/07/2025)

- 3.1. Entry Criteria
 - 3.1.1. Client and supervisor feedback on evaluation planning
- 3.2. Define evaluation scenario
 - 3.2.1. Requirement traceability
- 3.3. Exit Criteria
 - 3.3.1. Review and validate evaluation cases
 - 3.3.2. Validate with client
 - 3.3.3. Client feedback

The Evaluation Environment and Evaluation Execution Phases Combined Will Have Three Sprints, One for Each Linux Operating System.

4. Evaluation Environment Setup (21/07/2025 – 28/09/2025)

- 4.1. Entry Criteria
 - 4.1.1. Establishment of hardware and software
 - 4.1.2. Prepare evaluation data
 - 4.1.3. Configure evaluation environment
 - 4.1.3.1. Configure two computers as routers
 - 4.1.3.2. Configure three separate networks
 - 4.1.4. Write cases for each scenario
- 4.2. Exit Criteria
 - 4.2.1. Fully functional evaluation environment and approved evaluation cases
 - 4.2.2. Client feedback

5. Evaluation Execution Phase (04/08/2025 – 12/10/2025)

5.1. Entry Criteria

5.1.1. All exit criteria from previous steps

5.1.1.1. Evaluation environment is approved and functional

5.2. Exit Criteria

5.2.1. All evaluations are performed, and results are documented

5.2.1.1. Conduct a minimum of 10 evaluation runs for each operating system

5.2.1.1.1. Configure environment

5.2.1.1.2. Each evaluation consists of 12 packet sizes

5.2.1.1.3. Each evaluation will be run on both IPv4 and IPv6 separately

5.2.1.1.4. Each evaluation will be run on both TCP and UDP separately

5.2.1.2. Implement evaluation case failure protocol

5.2.1.3. Client feedback

5.2.1.4. Execute evaluation cases, scripts, pings

5.2.1.5. Record and document results for each evaluation run

5.2.1.6. Analyse performance metrics to determine operating system performance

5.2.1.7. Client feedback

5.2.1.8. Move onto next sprint

Sprint 1: Ubuntu (21/07/2025 – 17/08/2025)

Evaluation Environment Setup (21/07/2025 – 03/08/2025)

Evaluation Execution Phase (04/08/2025 – 17/08/2025)

Milestone 3 – Completion of Ubuntu Evaluation

Sprint 2: Fedora (18/08/2025 – 14/09/2025)

Evaluation Environment Setup (18/08/2025 – 31/08/2025)

Evaluation Execution Phase (01/09/2025 – 14/09/2025)

Milestone 4 – Completion of Fedora Evaluation

Sprint 3: Kali (15/09/2025 – 12/10/2025)

Evaluation Environment Setup (15/09/2025 – 28/09/2025)

Evaluation Execution Phase (29/09/2025 – 12/10/2025)

Milestone 5 – Completion of Kali Evaluation

6. Evaluation Closure (27/10/2025 - 31/10/2025)

6.1. Entry Criteria

6.1.1. Compile and compare results of evaluation

6.1.1.1. Analyse performance pattern

6.1.1.2. Summary of the network performance evaluation

6.1.1.3. Create visualisations and reports

6.1.1.4. Final poster

6.2. Exit Criteria

6.2.1. Document closure report

6.2.2. Evaluation results and analysis

6.2.3. Organise folders for portfolio

6.2.4. Client feedback

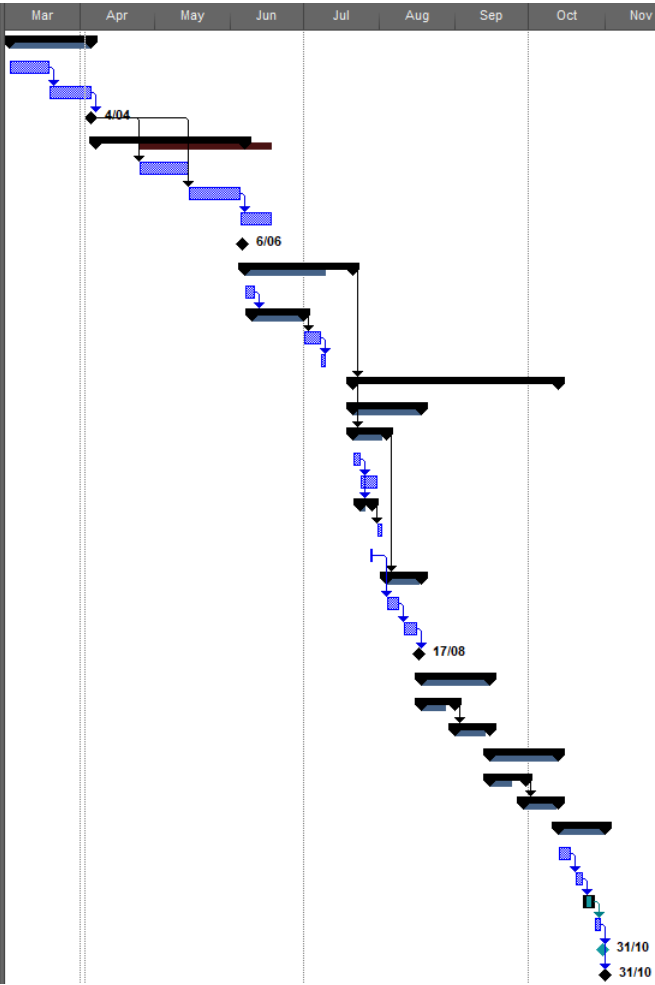
Milestone 6 – Final Poster

Appendix O – Gantt Chart

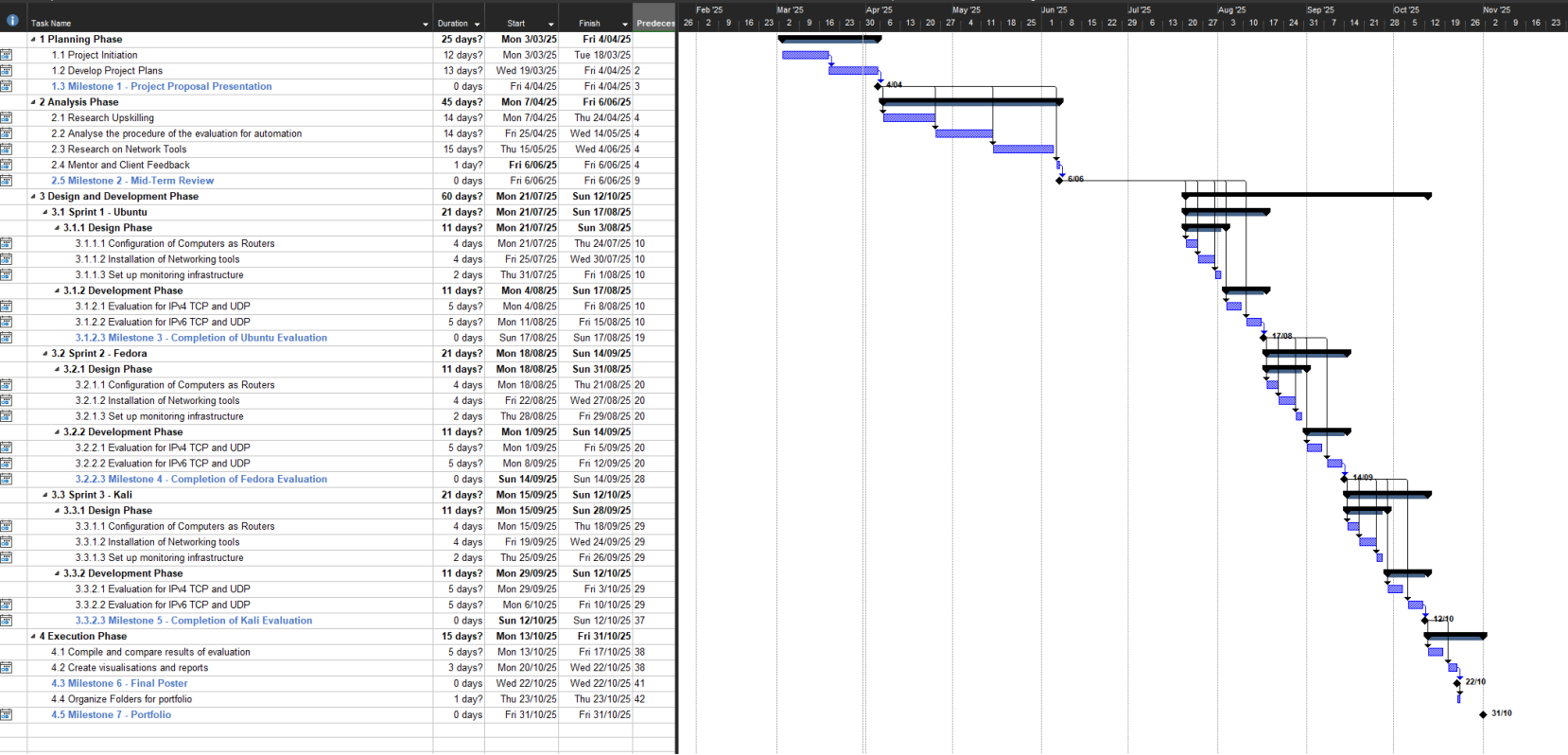
Physical Environment Team

	Task Name	Duration	Start	Finish	Predecessor
	1 Requirement Analysis	25 days?	Mon 3/03/25	Fri 4/04/25	
	1.1 Develop Project Proposal	12 days?	Mon 3/03/25	Tue 18/03/25	
	1.2 Develop Project Plans	13 days?	Wed 19/03/25	Fri 4/04/25	2
	1.3 Milestone 1 - Project Proposal Presentation	0 days	Fri 4/04/25	Fri 4/04/25	3
	2 Evaluation Planning	45 days?	Mon 7/04/25	Fri 6/06/25	
	2.1 Research Upskilling	14 days?	Fri 25/04/25	Wed 14/05/25	4
	2.2 Define Evaluation Scenarios	15 days	Thu 15/05/25	Wed 4/06/25	4
	2.3 Define Evaluation Environment	10 days	Thu 5/06/25	Tue 17/06/25	7
	2.4 Milestone 2 - Mid-Term Review	0 days	Fri 6/06/25	Fri 6/06/25	
	3 Evaluation Case Development	32 days?	Sat 7/06/25	Sun 20/07/25	
	3.1 Entry Criteria	3 days	Sat 7/06/25	Tue 10/06/25	
	3.2 Define Evaluation Scenario	15 days	Tue 10/06/25	Mon 30/06/25	11
	3.3 Review and Validate Evaluation Cases	5 days	Tue 1/07/25	Mon 7/07/25	12
	3.4 Client Feedback	2 days	Tue 8/07/25	Wed 9/07/25	14
	4 Evaluation Environment Setup and Evaluation Execution Phase	60 days?	Mon 21/07/25	Sun 12/10/25	10
	4.1 Sprint 1 - Ubuntu	21 days?	Mon 21/07/25	Sun 17/08/25	
	4.1.1 Evaluation Environment Setup	11 days?	Mon 21/07/25	Sun 3/08/25	10
	4.1.1.1 Establishment of hardware and software	3 days	Mon 21/07/25	Wed 23/07/25	
	4.1.1.2 Prepare Evaluation Data	5 days	Thu 24/07/25	Wed 30/07/25	19
	4.1.1.3 Configure Evaluation environment	3 days?	Thu 24/07/25	Mon 28/07/25	19
	4.1.1.4 Write Cases for each scenario	2 days	Thu 31/07/25	Fri 1/08/25	21
	4.1.1.5 Fully Functional Evaluation Environment and approved evaluation	1 day	Mon 28/07/25	Mon 28/07/25	23
	4.1.2 Evaluation Execution Phase	11 days?	Mon 4/08/25	Sun 17/08/25	18
	4.1.2.1 All Evaluations are performed	5 days?	Mon 4/08/25	Fri 8/08/25	25
	4.1.2.2 Conduct a minimum of 10 evaluation runs for each operating sys	5 days?	Mon 11/08/25	Fri 15/08/25	27
	4.1.2.3 Milestone 3 - Completion of Ubuntu Evaluation	0 days	Sun 17/08/25	Sun 17/08/25	28
	4.2 Sprint 2 - Fedora	21 days?	Mon 18/08/25	Sun 14/09/25	
	4.2.1 Evaluation Environment Setup	11 days?	Mon 18/08/25	Sun 31/08/25	
	4.2.2 Evaluation Execution Phase	11 days?	Mon 1/09/25	Sun 14/09/25	31
	4.3 Sprint 3 - Kali	21 days?	Mon 15/09/25	Sun 12/10/25	
	4.3.1 Evaluation Environment Setup	11 days?	Mon 15/09/25	Mon 29/09/25	42
	4.3.2 Evaluation Execution Phase	11 days?	Mon 29/09/25	Sun 12/10/25	44
	5 Evaluation Closure	15 days?	Mon 13/10/25	Fri 31/10/25	
	5.1 Compile and compare results of evaluation	5 days?	Mon 13/10/25	Fri 17/10/25	55
	5.2 Analyse performance pattern	3 days	Mon 20/10/25	Wed 22/10/25	57
	5.3 Summary of the network performance evaluation	3 days	Thu 23/10/25	Mon 27/10/25	58
	5.4 Create visualisations and reports	2 days	Tue 28/10/25	Wed 29/10/25	59
	5.5 Milestone 6 - Final Poster	0 days	Fri 31/10/25	Fri 31/10/25	60
	5.6 Milestone 7 - Portfolio	0 days	Fri 31/10/25	Fri 31/10/25	60

Linux Network Performance Evaluation



Physical Environment Team



Critical Path Analysis

Author: Win Phyoo

Date: 03/04/2025

Version: 1.1

Task name	ID	Estimated Duration	Predecessors	Start Date	End Date
Evaluation Case Development	10	32 days	5	07/06/2025	20/07/2025
Evaluation Environment Setup and Evaluation Execution Phase	16	60 days	10	21/07/2025	12/10/2025
Sprint 1 – ubuntu	17	21 days	10	21/07/2025	17/08/2025
Sprint 2 – Fedora	30	21 days	17	18/08/2025	14/09/2025
Sprint 3 – Kali	43	21 days	30	15/09/25	12/10/25
Evaluation Closure	56	15 days	16	12/10/25	31/10/25
Milestone 7 - Portfolio	62	0 day	60	31/10/25	31/10/25

The table above shows the list of tasks and summary that are indicated as critical to the project, the id, estimated duration, start date and the end date. The critical path analysis has been updated based on the network diagram in Gantt Chart.

Appendix P – Estimated Cost Breakdown

(PB Technologies, 2025).

Cost Category	Description	Quantity	Unit Cost (NZD)	Total Cost (NZD)
Hardware	Supermicro 521R-T Mini Server SVRSPM34170	4	\$2,686.65	\$10,746.60
Hardware	Philips 243V7QJAB/79 Monitor	4	\$161	\$644.00
Hardware	ASUS Vivobook Go 15 L510KA-EJ599W Laptop	7	\$667	\$4,669.00
Hardware	Rapoo X130PRO wired keyboard and mouse combo	4	\$23.14	\$92.56
Network Equipment	Cruxtec 0.5m Cat7 Ethernet Cable RS7-005-BK	3	\$5.45	\$16.35
Network Equipment	TP-Link TG-3468 32-bit Gigabit PCIe Network Adapter	6	\$22	\$132.00
Labour	Refer to labour breakdown table	-	-	\$109,420.80
Software Tools	iPerf	4	\$0	\$0.00
Software Tools	D-ITG	4	\$0	\$0.00
Total Estimated Cost				\$125,721.31

Appendix Q – Labour Breakdown Table

Role	Cost Breakdown	Average pay per hour (inc. GST)	Total Hours	Total Cost (NZD)
Mentor	Provided by AUT: \$142+GST	\$163.30	1 hour per week 24 weeks (2 sems) 1 x 24 = 24 hrs	163.30 x 24 = \$3,919.20
Project Manager	Average yearly salary: \$98,461 (PayScale, 2025)	\$47.34	15 hours per week 24 weeks (2 sems) 15 x 24 = 360 hrs	360 x 47.24 = \$17,006.40
Network Engineer (x4)	Average yearly salary: 78,377 (PayScale, 2024)	\$37.68	15 hours per week 24 weeks (2 sems) 15 x 24 = 360 360 x 4 = 1440 hrs	1440 x 37.68 = \$54,259.20
System Architect (x2)	Average yearly salary: \$98,895 (PayScale, 2023)	\$47.55	15 hours per week 24 weeks (2 sems) 15 x 24 = 360 hrs 360 x 2 = 720 hrs	720 x 47.55 = \$34,236.00

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