Network Performance Evaluation on   
Linux Based Operating Systems

Physical Environment Team

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# Version control

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| 13/03/2025 | 0.1 | Nathan | Initial document creation. |
|  | 1.0 | Nathan | Initial versioning and header |
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| 26/03/2025 | 1.1 | Thomas | Reformatting of document to make sections clearly defined |
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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 experience with Linux networking, Risk 1, Risk 2. The total cost budgeted to $xxxxxx, which covers the technology, labour, and tools needed for the project.

* Costs
  + Mentor
    - Based on a conservatively estimated time of one hour per week with the mentor, $3,919.20 is the estimated cost.
  + Equipment
    - 4 Computers
      * 1 Sender
      * 2 Configured as routers
        + Each with 2 network cards
      * 1 Receiver

# Terms of Reference

## Problem

The core issue is the absence of evidence to accurately assess the performance disparities between IPv4 and IPv6 within software router environments. Despite IPv4's acknowledged scalability constraints and IPv6's intended role as a replacement, a lack of real-world performance data hinders informed decision-making.

## Project purpose

The core purpose of this project is to evaluate and compare the network performance of IPv4 and IPv6 on Linux-based software routers. This evaluation will be conducted by measuring key metrics such as throughput, delay, jitter, and packet loss across various packet sizes.

## Opportunities

* This project presents an opportunity to gain valuable insights into IPv6 adoption barriers by providing concrete performance data.
* It also creates an opportunity to develop expertise in Linux networking, performance testing tools, and data analysis.
* The project also provides the opportunity to gain experience in creating and running a project, and the creation of a portfolio.

## Context of the project

IPv4's scalability issues drive the move to IPv6, which has different performance due to higher data overhead. This project aims to measure and provide factual performance results for both protocols within a controlled software router setting.

# Rationale

**Why is this project needed? Describe any existing system or  
area of enquiry undertaken and explain what the key project issues or opportunities are.**

# Project Objectives & Scope

This section will cover the main objectives, and the scope, including functional and non-functional requirements, key stakeholders, technical infrastructure, and skills analysis. For more complete details on the scope statement, please refer to Appendix X.

## Objectives

The goal of this project is to evaluate the performance of 3 latest Linux based Operating Systems distributions – Fedora OS, Ubuntu, and the team will need to choose the third operating system. 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:

* Configure operating systems as routers.
* Use TCP and UDP as transmission protocols.
* Test on both IPv4 and IPv6.
* Each test will be on 12 various packet sizes – 128, 256, 384, 512, 640, 768, 896, 1024, 1152, 1280, 1408, 1536 Bytes.
* Performance metrics to test for are – throughputs, delays, jitters, and packet loss. Each test needs to run at least 10 times to ensure accuracy and consistency. Any tests that fall outside 95% confidence interval must be re-run.

## Scope

### High-level Functional requirements

R1 - Must have 3 networks configured

R2 - Configuration of the Linux Operating System (Ubuntu, Fedora, and Kali) as router.

R3 - Network evaluation setup should utilise 4 computers, (2 routers, 1 sender, 1 receiver)

R4 -Use TCP and UDP as transmission protocols

### Non-Functional Requirements

R1 - Proper configuration and setup (Routers, and Network tools [iPerf and D-ITG])

R2 - All tests must be run 10 times each with all tests at 95% Confidence

R3 - Tests cover all 12 given packet sizes.

### Out of Scope

The team is not required for setup testbed environment for evaluation.

## Key Stakeholders

For complete and detailed list of stakeholders, and the stakeholder management plan, please refer to Appendix X.

## 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 X.

## Skills Analysis

This section covers the required skills for the project, along with analysis on the current skills of each member and the plans for upskilling. For complete details on skills analysis matrix, please refer to Appendix S.

The following table details the technical skills required for the completion of the project:

## Upskilling Plan Schedule

Summarise then reference to appendix

# Project Management Methodology

## Project Methodology

The chosen project management methodology is Scrum under the Agile sublets of project management. The project members have chosen to go with Scrum due to the nature of the project that requires frequent evaluation and changes of the development cycle and adjustments as per the requirements of the client.

## Rational/Justification:

The choice of scrum has been carefully reviewed after considering all types of projects management methods along with the different subsects of Agile. Waterfall was a method evaluated for this project, but it had clear drawbacks due to its fixed structure which didn't allow for changes and adjustments requested by clients or supervisor.

## Project Phases

**Short description of each phase along with an estimated time duration (dates)**

## Deliverables

The product-related deliverables include:

* Results of the evaluation for each Linux OS in Excel File.
* Log file for the evaluation
* Comparison of the results document

# Team Roles

This section covers all the team members and the assigned roles. For complete details on team contract and PMI code of ethic, please refer to Appendix X.

|  |  |  |
| --- | --- | --- |
| Member Name | Team Role | Assigned IP Version |
| Thomas Robinson | Scrum Master | IPv4 |
| Win Phyo | Product Owner | IPv4 |
| Zafar Afrad | Development Team Member | IPv4 |
| Kylie Afable | Development Team Member | IPv6 |
| Larissa Goh | Development Team Member | IPv6 |
| Nathan Quai Hoi | Development Team Member | IPv6 |
| Charmi Patell | Development Team Member | 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.

# Team Schedule

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

|  |  |
| --- | --- |
| Meeting | Time/ Date/ Location |
| Mentor/ Client Meeting | Every Thursday (Week 1 – 5) | 1PM | WZ1101  Thursday Fortnightly (Week 6 onwards) | 1PM | WZ1101 |
| Team Meeting | Every Thursday | 12 PM | Location WZ701  Advanced scheduling | Discord Online |

# Risk and Issues Register

For the complete details of Risk Register, issue register, and risk mitigation plan, please refer to appendix X.

Risk Register

* Incorrect router configuration affecting test results.
* Lack of Linux networking expertise.
* Hardware/software compatibility issues.

Issue Log

* D-ITG not available for Fedora.

Mitigation Strategies

* Research best practices for Linux router setup.
* Conduct preliminary evaluation before the main experiment.

# Project Plan

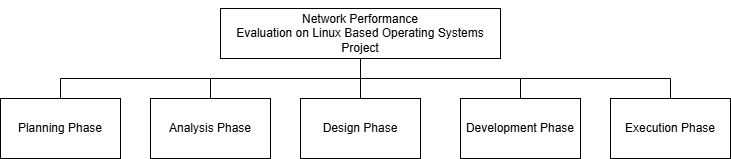
## Milestones

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 all the milestones.

|  |  |  |
| --- | --- | --- |
| **Date** | **Milestone Type** | **Milestone** |
| 04/04/2025 | External | Project Proposal Submission |
| 11/04/2025 | Internal | Project Proposal Presentation |
| 06/06/2025 | External | Midterm Review |
| 31/10/2025 | External | Poster |
| 31/10/2025 | External | Portfolio |
| 31/10/2025 | External | Comparison of evaluation results (Excel) |
| 31/10/2025? | ? | Reflective Report? |
| TBC | Internal | Evaluation for Ubuntu |
| TBC | Internal | Evaluation for Fedora |
| TBC | Internal | Evaluation for Kali |

## WBS, Tasking, Scheduling

This section displays a high-level view of the WBS and Gantt Chart.



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

# Estimated Costs

Summarise then reference to appendix

Costs table – Summary with category (Technology, Labour, Tools, etc.. Relevant cat)

Resource estimates

* Linux operating systems are free
* D-ITG and iPerf are free
* 4x computers
* 6x network cards
* Personal laptops ($1500 estimate)

# Labour Breakdown

Team’s time (not monetized).

* 15h per week
* 12 weeks in a semester
* 15h x 12 weeks = 144h x 2semesters = 360h (estimate)
* Average pay for a network engineer in NZ per hour = $30.99 NZD
  + (Network Engineer Salary in New Zealand, n.d.)
* $30.99 x 360h = $11,156.40 (estimate)

Mentor Costs Breakdown (which is put at $142 + GST per hour)

* $142+GST per hour.
* GST = 15%
* $142 x 15% (1.15) = $163.30
* At about an hour per week
  + 12 weeks x 1h = 12h x 2 semesters = 24h
* 24h x $163.30 = $3,919.20 (estimate)

# 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 –

# References

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