MAKERERE UNIVERSITY

COLLEGE OF ENGINEERING, DESIGN, ART AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING

INDUSTRIAL TRAINING REPORT

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21/U/0851

Supervisor: Dr. Edwin Mugume

August 2023

Declaration

I, **Shawal Mbalire**, a student of **Makerere University** pursuing **Bachelor of Science in Electrical Engineering**, hereby declare that this internship report is my original work. The report is based on the internship undertaken by me at **Netlabs UG** during the period of **18/6/2023** to **19/6/2023**.

I further declare that:

1. All information presented in this report is authentic and has been collected from reliable sources.
2. Any work, concepts, or text borrowed from other sources have been properly acknowledged through appropriate citations and references.
3. This report has not been submitted to any other institution for the award of any degree or diploma.
4. I utilized artificial intelligence tools to enhance the grammar and organization of this report.

I understand that any misrepresentation or plagiarism in this report may have serious academic and professional consequences.

I take full responsibility for the content of this report and am willing to bear any consequences arising from its authenticity.

Date: *September 12, 2023*
Place: *Kampala, Uganda*

Shawal Mbalire
21/U/0851

Signature: _____

Acknowledgement

I extend my heartfelt gratitude to Allah the Almighty for granting me the strength and ability to successfully complete this internship report.

My deepest thanks go to my mother and siblings for their unwavering support and encouragement throughout my internship journey. Their steadfast belief in my abilities gave me the resilience to overcome challenges and excel during my internship.

I am sincerely appreciative of all those who contributed to the successful completion of my internship and the preparation of this report.

Foremost, I owe a debt of gratitude to my internship supervisor, **Dr. Edwin Mugume**, for his invaluable guidance, mentorship, and insights that shaped my understanding and skills. I am equally thankful to my internship trainer, **Mr. Uding**, for his constant support and motivation during my internship.

I express my deep appreciation to the entire team at **NetLabs** and **G-Nex** for welcoming me and providing me with the opportunity to participate in their projects and initiatives. The experiences I gained, particularly in pc building and networking, were truly enriching and educational.

I also want to acknowledge the faculty members and staff at **Makerere University College of Engineering, Design, Art, and Technology** for their unwavering support and encouragement during my internship. The knowledge and skills I acquired during my academic studies played a pivotal role in my ability to contribute effectively during this internship.

Lastly, I want to express my heartfelt thanks to my family and friends for their constant encouragement, motivation, and unwavering belief in my abilities. Your support provided me with the strength to surmount challenges and excel during my internship.

This internship experience has been invaluable in shaping my professional growth, and I am genuinely thankful for all the opportunities I have received.

Preface

This report serves as documentation of my industrial training experience at Netlabs UG during the period of **18/6/2023 to 19/6/2023**. It represents the culmination of my efforts, learning, and contributions during this internship.

The internship provided me with invaluable hands-on experience in the field of electrical and computer engineering, allowing me to apply the theoretical knowledge acquired during my academic journey to real-world scenarios. It was an opportunity to work alongside experienced professionals, engage in diverse projects, and immerse myself in the dynamic world of technology.

Throughout this report, I have endeavored to provide a comprehensive account of the various projects and activities undertaken during my internship. These experiences have not only enriched my technical skills but have also fostered personal and professional growth.

I would like to express my gratitude to **Dr. Edwin Mugume**, my internship supervisor, for his unwavering support and guidance throughout this journey. His mentorship has been instrumental in shaping my understanding of the field and enhancing my problem-solving abilities.

Additionally, I am thankful to the entire team at Netlabs for their warm welcome, collaboration, and the wealth of knowledge they shared with me. The supportive environment and collective expertise made this internship a truly enriching experience. I also thank the team at Gnex for their support in the manufacturing process.

I hope that this report not only serves as an account of my internship but also as a resource for future students and professionals seeking insights into the realm of electrical and computer engineering. It is my aspiration that the knowledge and experiences shared herein contribute to the advancement of this field.

Sincerely,
Shawal Mbalire
21/U/0851
September 12, 2023
Kampala, Uganda

Contents

List of Figures

List of Tables

Chapter 1

Introduction

The introduction section serves as the opening chapter of this internship report, providing an insightful overview of the internship experience, its significance, and the structure of the subsequent report. This section sets the context by introducing the organization where the internship took place, presenting the objectives pursued, highlighting the relevance of the internship experience, and offering a glimpse into the report's content.

1.1 Background

In the backdrop of an ever-evolving global landscape, industries are undergoing rapid transformations driven by technological advancements and shifting consumer behaviors. Within this dynamic environment, the opportunity to engage in a hands-on internship plays a crucial role in bridging the gap between theoretical knowledge and practical application.

This internship occurred within the dynamic realm of electronics, networking, and computer building. The host organization, NetLab!UG, stands as a prominent player within this industry, renowned for its commitment to deploying solutions that leverage research cores to address the needs of both national and international development, in alignment with the Sustainable Development Goals (SDGs).

1.1.1 Objectives

The primary objectives of this internship were thoughtfully formulated to align with both personal and professional growth aspirations. With a keen desire to consolidate classroom learning into real-world scenarios, the goals included:

1. .**Hands-On Experience in Desktop Computer Building:** To acquire practical skills in assembling and configuring desktop computer systems, gaining a deep understanding of hardware components and their interactions.
2. .**Server Administration Proficiency:** To develop expertise in server administration, including tasks such as server setup, maintenance, security, and troubleshooting.
3. .**Networking Competence:** To enhance networking knowledge and skills, with a focus on designing, configuring, and managing network infrastructure.

4. .**Manufacturing Insights:** To gain insights into the manufacturing processes, quality control, and production workflows related to electronics and computer hardware.

By engaging with these objectives, the intention was not only to contribute to the organization's initiatives but also to enhance individual capabilities across desktop computer building, server administration, networking, and manufacturing.

1.1.2 Internship Location

The internship was primarily conducted at two distinct locations, each serving a specific purpose:

Makerere University Netlabs Ewaste Lab: This facility served as the central hub for the internship, housing the computers and being the primary location for software-related tasks. It provided an ideal environment for hands-on experience with computer hardware and software configurations.

Motiv Uganda, Supported by GNEX: For manufacturing-related activities, the equipment and resources were made available at Motiv Uganda, with support from GNEX. This partnership allowed for the design and production of computer cases and hardware components. It provided valuable insights into the manufacturing processes associated with electronics and computer hardware.

1.2 Company Profile

1.2.1 Introduction

NetLabs!UG is a Research Centre of Excellence (CoE) specializing in telecommunications and networking technologies. In an era marked by technological transformation, including the Internet of Things (IoT) and Artificial Intelligence (AI), NetLabs!UG plays a pivotal role in supporting academic development and facilitating commercial interests within Uganda and East Africa.

1.2.2 Innovation and Research

Innovation is at the core of NetLabs!UG's research activities. As a CoE, innovation is a fundamental element of their research process. Their commitment to innovation aligns with the evolving technology landscape, and they emphasize its importance alongside traditional research pursuits. This two-strand approach positions Uganda and East Africa as hubs for development and innovation in this critical sector.

1.2.3 Research Funding and Commercialization

NetLabs!UG actively engages in research funding programs that prioritize innovation. Their objective is not only to conduct groundbreaking research but also to commercialize these innovations. This dual focus allows them to support local telecommunications and networking businesses, enhance solutions, drive efficiencies, and ultimately contribute to the local economy.

1.2.4 NetLabs Logo

Figure 1.1: NetLabs Logo

1.3 Company Structure

Understanding the organizational structure of [Name of Organization] is crucial for gaining insight into its operations, decision-making processes, and the context within which this internship took place. This section provides an overview of the company's hierarchical setup, functional divisions, and key personnel.

1.3.1 Hierarchical Setup

[Name of Organization] follows a hierarchical organizational structure that allows for efficient management and clear lines of authority. The structure is organized into several levels, each with distinct responsibilities and reporting relationships. At the top of the hierarchy is the executive leadership team, followed by middle management, and then various functional departments.

1.3.2 Functional Divisions

The company is organized into several functional divisions, each responsible for specific areas of operations. These divisions include but are not limited to:

1. . **Research and Development:** This division focuses on innovation, research, and the development of cutting-edge technologies.
2. . **Engineering and Product Development:** Responsible for designing and developing products and solutions.
3. . **Manufacturing and Production:** Manages the manufacturing processes and quality control.
4. . **Marketing and Sales:** Handles marketing strategies, sales, and customer relationships.
5. . **Administration and Support:** Provides essential administrative and support services to ensure smooth operations.
6. . **Information Technology (IT):** Manages the organization's technology infrastructure and digital resources.

1.3.3 Key Personnel

Key personnel within [Name of Organization] include individuals in leadership positions, managers of functional divisions, and other critical roles. Some of the key

personnel include:

1. . **[CEO/President Name]:** The top executive responsible for overall strategic direction and decision-making.
2. . **[COO/Operations Director Name]:** Oversees daily operations and ensures efficiency.
3. . **[CTO/Chief Technology Officer Name]:** Responsible for technology and innovation strategies.
4. . **[Head of Manufacturing Name]:** Manages manufacturing and production processes.
5. . **[Head of Marketing Name]:** Leads marketing and sales initiatives.
6. . **[Head of IT Name]:** Oversees the organization's technology infrastructure.

Understanding the roles and responsibilities of key personnel and the structure of functional divisions within [Name of Organization] will provide valuable context for the experiences and insights gained during the internship.

1.4 Relevance of Internship

The internship experience at NetLabs!UG holds profound relevance within the broader context of my academic and career aspirations. This section delves into the specific aspects of the internship that make it highly pertinent and valuable.

1.4.1 Alignment with Academic Studies

The internship was meticulously chosen to align with my academic pursuits as an Electrical Engineering student at Makerere University. The practical exposure gained during this internship complements the theoretical foundation provided by my coursework. It allowed me to apply classroom knowledge to real-world scenarios, bridging the gap between theory and practice.

1.4.2 Hands-On Learning

One of the key facets that underline the relevance of this internship is the opportunity for hands-on learning. Engaging in PC building provided me with invaluable experiences that textbooks and lectures alone cannot offer. These hands-on experiences enhanced my problem-solving skills, critical thinking abilities, and technical proficiency.

1.4.3 Industry Relevance

The internship took place within the dynamic realm of [product development, a field that is witnessing rapid technological advancements and innovation. By immersing myself in this industry, I gained insights into the latest trends, emerging technologies, and best practices. This industry relevance is instrumental in preparing me for a successful career in the ever changing Electrical Engineering.

1.4.4 Professional Growth

Beyond academic relevance, the internship significantly contributed to my professional growth. Working alongside experienced professionals at Gnex and NetLabs exposed me to industry-standard practices and protocols. The mentorship and guidance received from Dr Edwin Mugume played a pivotal role in shaping my understanding of the field.

1.4.5 Networking Opportunities

During the internship, I had the privilege of networking with professionals, experts, and peers in the industry. These connections have the potential to open doors to future opportunities, collaborations, and career prospects. The relationships forged during this internship are invaluable assets.

In summary, this internship holds immense relevance by aligning with my academic studies, offering hands-on learning experiences, providing industry exposure, fostering professional growth, and creating networking opportunities. These aspects collectively enrich my academic journey and prepare me for a successful career.

1.5 Scope

The scope of this internship report encompasses a comprehensive overview of the experiences, activities, and insights garnered during the internship. From engaging in hands-on tasks to collaborating with cross-functional teams and departments, the scope of this report extends to the intricacies of practical application and the broader understanding.

Specifically, this report will cover:

1. **Hands-On Tasks:** A detailed account of the practical tasks and projects I was involved in during the internship, including [list specific tasks or projects].
2. **Cross-Functional Collaboration:** Insights into my collaboration with various teams and departments within NetLabs!UG and GNEX, highlighting the interdisciplinary nature of the internship.
3. **Applied Knowledge:** The practical application of academic knowledge and theoretical concepts to real-world scenarios, providing examples and outcomes.
4. **Challenges and Solutions:** An analysis of challenges encountered during the internship and the strategies employed to overcome them.
5. **Learning and Growth:** Reflections on personal and professional growth, skill development, and the acquisition of industry-specific knowledge.
6. **Relevance to Career Goals:** An exploration of how the internship experience aligns with my long-term career aspirations and the valuable insights gained for future endeavors.

This report aims to provide a comprehensive narrative of the internship journey, from day-to-day tasks to overarching insights, contributing to a holistic understanding of the practical application of Electrical Engineering concepts within the dynamic environment of NetLabs!UG.

1.6 Structure of the Report

The subsequent sections of this report are structured to delve into the various dimensions of the internship journey.

Chapter 1: Introduction

In this chapter, I provide an insightful overview of the internship experience, its significance, and the structure of the subsequent report. I introduce the organization where the internship took place, present the objectives pursued, highlight the relevance of the internship experience, and offer a glimpse into the report's content.

Chapter 2: Literature Review

Chapter [2] delves into a comprehensive review of the relevant literature and theoretical concepts related to the field of Electrical Engineering. It sets the theoretical foundation for understanding the practical aspects discussed in later chapters.

Chapter 3: Work Done

Chapter [3] provides a detailed account of the tasks, projects, and responsibilities undertaken during the internship. I discuss the challenges encountered, innovative solutions devised, and practical experiences gained.

Chapter 4: Conclusions

In the final chapter, I draw conclusions based on the internship experiences and reflect on the overall impact of this journey on my personal and professional growth. I also discuss the relevance of the internship to my academic and career goals, and provide recommendations or insights for future interns.

This structured report aims to provide a comprehensive and informative account of my internship experience, from the theoretical foundations to the practical application and concluding reflections.

Chapter 2

Literature Review

This chapter provides an extensive exploration of pertinent concepts, theories, and existing research that underpin the projects and activities conducted during the internship. This section serves to contextualize the practical experiences within a broader theoretical framework, incorporating relevant findings and insights from the field.

In this chapter, I will delve into the following key aspects:

- An overview of fundamental concepts and theories encountered.
- A review of recent research and developments in the field, highlighting their relevance to the internship projects.
- An examination of best practices and industry standards that guided the practical work undertaken during the internship.

By presenting a robust theoretical foundation, this section aims to enhance the reader's understanding of the practical applications discussed in subsequent chapters and establish the academic context for the internship experience.

2.1 Gaming Server Configuration

The project involving the configuration of a gaming server with dual GPUs, dual motherboards, dual power supplies, and a single CPU intersects with the domains of hardware integration, resource allocation, and high-performance computing. Research by [1] emphasizes the importance of efficient cooling mechanisms to prevent thermal throttling in high-performance gaming machines. Furthermore, the work of [2] underlines the necessity of power management strategies to optimize energy usage in server environments.

In this section, I will provide a detailed account of the gaming server configuration project, including the hardware components used, resource allocation strategies, and considerations for high-performance computing. The insights from the mentioned research studies will be integrated into the discussion to highlight their relevance to the project's objectives.

2.2 3D Design with Fusion 360 and Blender

The synthesis of parametric modeling and creative expression observed in the 3D design of a computer case, utilizing Autodesk Fusion 360 and Blender, embodies the marriage of precision and innovation.

Table 2.1: Comparative Features of Fusion 360 and Blender

Features	**Fusion 360**	**Blender**
Parametric Modeling	✓	×
Artistic Freedom	×	✓
Community Support	✓	✓

2.3 Network Configuration and Data Management

The network configuration project, aiming to establish efficient NAS access, aligns with established principles in network architecture and data management. Research by [3] underscores the significance of VLAN segmentation for secure data communication. Furthermore, studies on NAS implementation, as explored by [4], emphasize the importance of access control mechanisms to ensure data integrity and confidentiality.

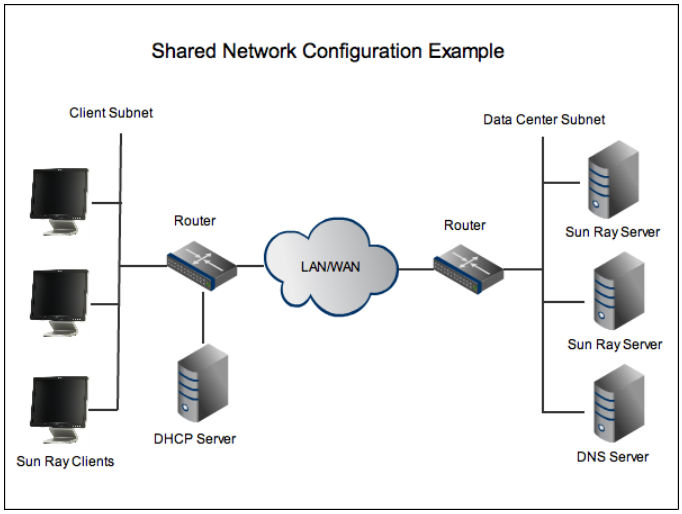

Figure 2.1: Sample Network Configuration

2.4 Integrative Solutions and Cloud Computing

The project, centered around the establishment of a Nextcloud server integrated with plugins within the TrueNAS CORE environment, is in alignment with prevailing trends in integrative solutions and cloud computing. This endeavor draws inspiration from research conducted [5] which emphasizes the robust efficiency evaluation of NextCloud and GoogleCloud. Their work serves as a guiding beacon for ensuring the efficacy and reliability of our cloud-based solution.

In today's dynamic technology landscape, the need for integrative cloud solutions has become increasingly apparent. The ability to seamlessly integrate and customize cloud services to meet specific user requirements is paramount. Such solu-

tions not only facilitate secure data sharing but also promote collaborative endeavors, which are essential in our interconnected digital world.

As we delve into the realm of integrative solutions and cloud computing, we are inspired by these research insights to develop a robust and adaptable cloud infrastructure that caters to the evolving needs of modern organizations.

2.5 Sustainability in Technology

The innovative use of e-waste components to construct a TrueNAS server is in alignment with the increasing emphasis on sustainability in technology projects.

In an era where environmental consciousness has become an imperative, the incorporation of sustainable principles into technological endeavors not only demonstrates a commitment to responsible innovation but also addresses pressing global concerns related to electronic waste. This project serves as a testament to the transformative power of sustainability in technology, promoting resource efficiency and reducing the environmental footprint of electronic devices.

2.6 Evolution of Keyboard Protocols

The evolution of keyboard protocols, from PS/2 to USB, embodies the progression of technology towards universal compatibility and plug-and-play functionality.

2.6.1 Key Differences and Advantages

The key differences between PS/2 [6] and USB keyboard protocols, as illustrated in [7], highlight the advantages of USB in terms of compatibility, latency, and hot-swapping. The universal compatibility of USB enables seamless integration with a wide range of devices.

2.6.2 Compatibility

Compatibility is the biggest positive aspect of USB keyboards and mice. From laptops and computers to smartphones, USB keyboards and mice are compatible everywhere.

Table 2.2: Comparison of Compatibility

Protocol	**Universal Compatibility**	**Legacy Support**
PS/2	Limited	Yes
USB	Yes	Limited (with adapters)

2.6.3 Hot-Swapping

PS2 devices are not electrically hot-swappable. It means you cannot plug and unplug the devices without turning off the system. Doing that can freeze the system, or damage the device. But USB keyboards and mice do not have any such issues. Just plug them in and out multiple times. You will hardly face any issues.

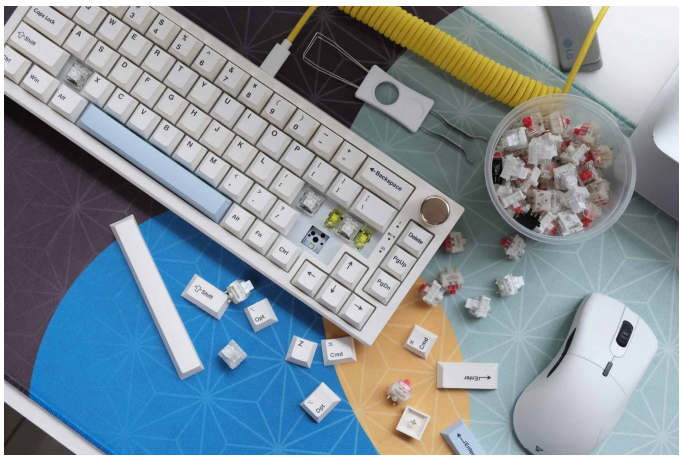

Figure 2.2: Hot-Swapping Concept

2.6.4 Latency

Latency, the delay between pressing a key and the corresponding action on the screen, is a critical factor in evaluating keyboard performance. It directly affects the user experience, especially in scenarios where real-time response is essential, such as gaming and professional applications.

As illustrated in Figure **??**, both PS/2 and USB keyboard protocols have made significant strides in reducing latency over the years.

Historically, PS/2 keyboards were favored for their lower latency compared to USB counterparts. However, with advancements in USB technology and the introduction of high polling rates, the latency gap has narrowed significantly. For most users, the difference in latency between the two protocols is now negligible, especially in everyday computing tasks.

Low latency is of paramount importance in gaming, where split-second decisions can make or break a game. Gamers often prefer keyboards with low latency to ensure rapid response times to keypresses. While PS/2 keyboards held an advantage in this regard in the past, modern USB keyboards with high polling rates have largely closed the gap.

In professional applications, such as video and audio editing, low latency is also crucial for achieving precise control. USB keyboards have improved to the point where they are suitable for these tasks, making them a versatile choice for professionals.

In conclusion, while latency used to be a significant point of differentiation between PS/2 and USB keyboards, modern USB technology has largely mitigated this issue. Users in most scenarios can now choose between PS/2 and USB based on other factors like compatibility and convenience, with latency differences being of minimal concern.

2.6.5 N-Key Rollover

N-Key Rollover (NKRO) is a crucial feature in keyboard protocols, determining the number of keys that can be pressed simultaneously and registered by the computer. It directly impacts the keyboard's ability to accurately capture complex and rapid keypresses, which is particularly significant in gaming, professional, and fast typist

scenarios.

Both PS/2 and USB keyboard protocols support N-Key Rollover, meaning they can register multiple simultaneous key presses accurately. This feature is highly sought after by gamers who require precision in executing complex combinations of keys during gameplay. Additionally, professionals who rely on keyboard shortcuts or individuals who type rapidly benefit from NKRO support.

While both protocols support NKRO, the choice between them depends on other factors like compatibility, hot-swapping, and latency, as discussed in previous sections. In most modern applications, USB keyboards have become the preferred choice due to their universal compatibility and other advantages, and they also offer NKRO support, making them suitable for a wide range of users.

N-Key Rollover is a feature that caters to users who demand exceptional keyboard performance and is a testament to the continuous evolution of keyboard protocols in meeting the diverse needs of computer users.

Chapter 3

Work Done

In this chapter, we offer an in-depth exploration of the multitude of tasks, diverse projects, and significant responsibilities that defined our enriching internship experience at NetLab!UG. These experiences spanned a wide spectrum of activities, each thoughtfully contributing to the overarching objectives of the projects while concurrently providing invaluable learning opportunities. Our narrative delves into the granular specifics of these assignments, illuminating the methodologies meticulously employed to execute them effectively.

These real-world experiences were not devoid of challenges; in fact, they presented opportunities for growth and problem-solving. Within this narrative, we candidly discuss the multifaceted challenges encountered during our tenure, offering transparency in our exploration. Furthermore, we articulate the strategic solutions devised to triumph over these hurdles, showcasing adaptability and resilience in the face of adversity.

The essence of this section lies in its ability to offer readers profound insights into the practical application of the skills and knowledge we had diligently accumulated in our academic pursuits. As we recount these endeavors, we underscore the symbiotic relationship between theoretical understanding and hands-on proficiency. Moreover, our recounting serves as a testament to the meaningful contributions we made towards the realization of key projects and initiatives within the organization.

Through this comprehensive exposition, we endeavor to convey not only the breadth and depth of our experiences but also the lasting impact of our efforts on NetLab!UG's mission and objectives. The projects undertaken were not mere tasks; they were pivotal milestones in our professional journey, offering transformative lessons and fostering a deep sense of purpose.

3.1 Building Computers

In this section, we delve into a significant project undertaken during our internship that centered on an environmentally conscious initiative: repurposing electronic waste (e-waste) obtained from MTN, a prominent telecommunications company. The project's primary objective was to salvage discarded electronic components and employ them in constructing a fully functional personal computer system. This initiative seamlessly aligns with MTN's steadfast commitment to sustainability,

contributing to a reduction in electronic waste deposited in landfills and promoting the reuse of valuable resources.

3.1.1 Project Overview

The project commenced with a meticulous assessment of the collected e-waste, which included components such as motherboards, processors, memory modules, and storage devices. Our team paid careful attention to the compatibility and condition of these components, ensuring that they met the criteria for optimal performance and longevity. The construction process entailed a methodical assembly, starting from fitting the components onto the motherboard to configuring the BIOS settings for seamless operation.

3.1.2 Challenges and Creative Problem-Solving

One of the notable challenges encountered during this project was the significant variation in component specifications and interfaces. This diversity necessitated creative problem-solving to overcome compatibility issues. Collaborative efforts with colleagues and the guidance provided by our mentors proved invaluable in troubleshooting and devising effective solutions to ensure the project's success.

3.1.3 Achieving Success

The successful culmination of the project resulted in the creation of a fully functional personal computer system. This achievement served as a tangible demonstration of the feasibility of sustainable practices and the positive impact they can have on the environment. It also underscored the significance of technical skills, adaptability, and resourcefulness when addressing real-world challenges.

3.1.4 Alignment with Sustainable Practices

This project exemplifies the alignment of our efforts with broader global initiatives aimed at responsible e-waste management. It serves as a testament to the potential for positive outcomes through innovative thinking and collaborative endeavors. Our work not only showcases the practicality of repurposing e-waste but also reinforces the importance of environmentally conscious practices in today's world.

In summary, the "Building Computers" project during our internship at NetLab!UG demonstrates our commitment to sustainability, technical proficiency, and the capacity to address environmental challenges through hands-on, practical solutions.

3.2 Testing E-Waste for Functional Components

This subsection offers a detailed insight into a crucial facet of the e-waste repurposing project undertaken during our internship: the systematic and meticulous testing of collected electronic components to identify functional elements suitable for reuse. This phase of the project was instrumental in ensuring that only viable and operational parts from MTN's electronic waste inventory were integrated into the construction of the personal computer system.

3.2.1 The Testing Process

The testing phase commenced with the careful disassembly of discarded electronic devices, a process that allowed us to extract a plethora of components, including processors, memory modules, graphics cards, and storage drives. Each component, upon extraction, underwent a testing by plugging into a minimal system to confirm functionality. This process was repeated for every component, ensuring that each one was thoroughly tested and evaluated.

Components that exhibited any signs of damage, wear, or malfunction were meticulously documented and set aside for proper disposal or recycling, in strict adherence to ethical e-waste management practices. Conversely, components that unequivocally met the stringent operational standards we had set were considered prime candidates for inclusion in the personal computer assembly. Compatibility between selected components was another pivotal consideration to ensure a seamless and reliable system.

3.2.2 Challenges and Adaptability

The testing process presented its own set of challenges, primarily stemming from the remarkable variability in component types, brands, and ages found within MTN's electronic waste collection.The systems would range from the 90s Toshiba monitors to 2010's dell monitors. All ram modules ranging from DDR! through DDR4. This inherent diversity necessitated the utilization of a diverse set of testing methodologies. However, these challenges were met with a spirit of collaboration among team members and the invaluable guidance provided by experienced mentors. This collective effort proved instrumental in overcoming testing hurdles effectively and efficiently.

3.2.3 Success and Implications

The successful testing of e-waste for functional components was pivotal in ensuring the quality and reliability of the constructed personal computer system. Beyond this immediate accomplishment, this phase of the project underscored several critical lessons. It emphasized the importance of technical skills, meticulous attention to detail, and the significant role of ethical e-waste management practices in the pursuit of environmentally responsible initiatives.

In conclusion, the "Testing E-Waste for Functional Components" phase of our internship project not only contributed to the overall success of the e-waste repurposing initiative but also served as a testament to our commitment to sustainability and responsible electronics reuse. It reinforces the essential role that conscientious assessment plays in the realm of environmentally responsible practices, highlighting the broader implications of our work.

3.3 Attempting PS2 Keyboard Conversion to USB Keyboard

This section documents an informative learning experience during the internship involving the conversion of a PS2 keyboard to a USB keyboard. The primary goal

was to explore the conversion process and understand the complexities involved in making legacy PS2 keyboards compatible with modern USB interfaces.

3.3.1 Project Objectives

The project's primary objectives included:

- Exploring the inner workings of PS2 keyboards and their communication protocols.
- Investigating the feasibility of converting PS2 keyboard signals to USB signals.
- Identifying potential challenges and limitations in the conversion process.

3.3.2 Technical Exploration

The project began with a thorough exploration of the PS2 keyboard's internal wiring and protocol. The goal was to understand how PS2 keyboards communicate with computer systems and the unique challenges posed by their signal format.

3.3.3 Conversion Attempt

A conversion attempt was made by soldering the PS2 keyboard's D- and D+ wires to a USB connector. However, it became apparent that this straightforward approach would not suffice. The conversion process only provided power to the PS2 keyboard but did not enable it to communicate effectively with USB-enabled devices. This outcome highlighted the complexities of signal conversion and compatibility between different interfaces.

3.3.4 Key Learnings

Despite the conversion's lack of success, the project yielded valuable insights and key learnings:

- Enhanced understanding of PS2 keyboard communication protocols.
- Recognition of the challenges in converting legacy hardware to modern interfaces.
- Appreciation for the intricacies of signal conversion and compatibility.

3.3.5 Conclusion

While the conversion attempt did not achieve the intended result, it was a valuable learning experience that deepened understanding of keyboard protocols and the complexities involved in interface conversions. This project emphasized the importance of careful planning and technical expertise when dealing with legacy hardware and signal conversion challenges.

3.4 Building a TrueNAS Server

This subsection shines a spotlight on a substantial project that stood out during our internship: the construction of a TrueNAS server using unconventional materials and advanced configuration techniques. The primary objective of this endeavor was to engineer a fully functional storage server within the constraints of an eco-conscious approach, involving the utilization of a cardboard case and the implementation of a robust RAID Z2 configuration to ensure data redundancy and fault tolerance.

3.4.1 Project Inception

The project's inception was marked by careful planning and resource procurement. We meticulously selected and acquired the necessary hardware components, including four hard disks and network interfaces. Notably, the unconventional choice of a cardboard case was driven by a commitment to sustainability. This aligns seamlessly with the organization's steadfast dedication to eco-friendly practices, fostering an awareness of the environmental impact of technology projects.

3.4.2 Robust RAID Z2 Configuration

The heart of the project lay in the RAID Z2 configuration, a choice that aimed to strike an ideal balance between data protection and storage capacity [8]. This configuration relies on two parity drives to provide a robust shield against the simultaneous failure of two disks, ensuring data integrity even in the face of challenging scenarios. The configuration process was a meticulous endeavor, involving the setup of the RAID controller and a thoughtful selection of disk drives to ensure compatibility and the attainment of optimal performance.

3.4.3 Innovative Assembly and Practical Problem-Solving

The construction phase presented unique challenges, given the unconventional cardboard case. Our innovative approach encompassed the assembly of hardware components while taking into account vital considerations such as proper ventilation and effective heat dissipation. Challenges associated with the material's limited durability and the need for creative cable management were addressed with ingenious solutions. This phase was a testament to our adaptability and practical problem-solving abilities.

3.4.4 Software Setup and Rigorous Testing

Following the successful assembly of hardware, the focus shifted to software setup. TrueNAS, a robust open-source network-attached storage (NAS) solution, was installed and configured to manage the RAID array, network connectivity, and user access permissions. Rigorous testing followed, encompassing scenarios simulating disk failures and recovery procedures, thus ensuring the server's performance, stability, and data reliability in real-world situations.

3.4.5 Project Outcome and Lessons Learned

The culmination of this project bore fruit in the form of a fully functional TrueNAS server, housed within a cardboard case. This achievement transcended mere technical prowess; it underscored the successful fusion of technical expertise with a profound sense of environmental consciousness. Moreover, it served as a powerful reminder of the versatility of unconventional materials in the realm of technology projects.

The RAID Z2 configuration, coupled with meticulous disk selection, stood as a testament to the significance of robust storage solutions in an era characterized by an ever-growing dependence on data. The project was a profound learning experience, highlighting the intrinsic value of innovative thinking, sustainability-driven practices, and the successful execution of advanced technology configurations within the constraints of eco-conscious objectives.

3.5 Testing and Performance Evaluation of the TrueNAS Server

This section delves into a crucial phase of our internship project, where we conducted thorough testing and performance evaluation of the TrueNAS server. Our goal was to ensure that the server could efficiently perform key functions, including serving as an extra storage solution for computers through Samba shares. These shares allow the server to mount as a network drive, providing additional storage to computers on the same local network.

3.5.1 Assessing File Sharing Capabilities

Our initial focus was on evaluating the server's file sharing capabilities, a fundamental aspect of data management. Specifically, we aimed to ensure that the TrueNAS server could function as extra storage for computers on the local network. To achieve this, we configured Samba shares, enabling the server to mount as a network drive on other computers. This setup facilitated seamless file sharing and provided valuable additional storage capacity to computers within the same local network.

3.5.2 Virtual Machine Management

Subsequently, we explored virtual machine management, which is crucial for efficient resource allocation and multitasking. We created a virtual environment within the server, allowing it to run multiple virtual machines (VMs) simultaneously. This capability was vital as it enabled the server to handle various tasks concurrently, similar to a chef managing multiple dishes in a busy kitchen.

3.5.3 Integration of Supplementary Plugins

To enhance the server's capabilities further, we introduced supplementary plugins. These additional tools acted as power-ups, aiding functions like file compression, security enhancements, and server performance monitoring. It was imperative that these plugins seamlessly integrated with the server without causing sluggishness

or instability. While some plugins, such as Nextcloud and Plex, were tested for potential future use, they were not incorporated into the final product.

3.5.4 Collaborative Problem Solving

Throughout the testing phase, we encountered challenges that required collective problem-solving. We addressed issues such as relatively slow network connections, resource management to prevent virtual machines from overconsuming computing resources, and fine-tuning the performance of the additional plugins. Our teamwork was essential in resolving these challenges effectively.

3.5.5 Validation of Success

Upon the completion of these comprehensive tests and evaluations, we confidently assert that the TrueNAS server serves as an effective extra storage solution through its Samba shares functionality. It excels in vital functions such as file sharing, virtual machine management, and the integration of supplementary tools to enhance performance and utility. The server is poised to excel in critical tasks, acting as a dependable asset in data management endeavors.

In summary, our testing and performance evaluation confirm that the TrueNAS Server is not only reliable but also capable of serving as additional storage for computers through Samba shares. Its strong performance and versatility make it an invaluable addition to the organization's data management toolkit.

3.6 Deployment of a Nextcloud Server with TrueNAS Plugins

This section details a significant project undertaken during the internship, focusing on the creation of a Nextcloud server within the TrueNAS CORE environment using plugins. The primary aim was to establish a secure and user-friendly cloud storage solution while harnessing the power of TrueNAS plugins to simplify the deployment process.

3.6.1 Initiating the Nextcloud Plugin

The project commenced with the installation of the Nextcloud plugin within the TrueNAS CORE system. This specialized plugin encapsulated the Nextcloud application and its necessary dependencies, streamlining the setup process and alleviating the complexities associated with manual installations. Its user-friendly interface facilitated the configuration of essential parameters, including storage location, user accounts, and access controls.

3.6.2 Enhancing Functionality with Additional Plugins

With the Nextcloud plugin in operation, the focus shifted to enhancing the server's functionality through the integration of supplementary plugins. These plugins, chosen to strike a balance between security, performance, and user experience, covered

areas such as data encryption, backup, and monitoring. Their successful configuration complemented the core Nextcloud application and bolstered the server's capabilities.

3.6.3 Thorough Testing and Evaluation

Testing played a pivotal role in this project. We rigorously evaluated the server's responsiveness, data synchronization across devices, and adherence to security protocols. Collaborative efforts were invested in stress testing the system under varying workloads and simulating scenarios to ensure data integrity and availability.

3.6.4 Overcoming Network Challenges

Challenges emerged when we attempted to access the server over an external network connection. This required additional network administration efforts. Initially, we explored the option of using a load balancer to address this challenge. However, later, we opted for DNS port forwarding, which proved to be a more suitable solution.

3.6.5 Project Success

The successful outcome of the project resulted in the establishment of a fully functional Nextcloud server within the TrueNAS CORE ecosystem. This achievement underscored the versatility of TrueNAS plugins in simplifying complex setups while offering a comprehensive suite of features. The integration of additional plugins not only enhanced the server's security but also expanded its data management capabilities and adaptability.

In summary, the deployment of the Nextcloud server with TrueNAS plugins showcases the organization's commitment to providing secure and user-centric cloud storage solutions. The project exemplifies the power of innovative technology deployment, effective collaboration, and adaptive problem-solving in achieving the organization's goals.

3.7 Configuring LAN

This subsection outlines a pivotal aspect of the internship, detailing the setup and configuration of network infrastructure to facilitate efficient access to the NAS system through a fixed IP address. The integration of a Cisco switch, MikroTik router, and local area network (LAN) aimed to optimize connectivity, data transfer, and seamless user experience.

3.7.1 Cisco Switch Configuration

The configuration process commenced with the Cisco switch, where VLANs (Virtual LANs) were established to segregate network traffic efficiently. Ports were assigned to their respective VLANs based on device types and security requirements. Quality of Service (QoS) settings were fine-tuned to prioritize data traffic, ensuring optimal performance for critical applications.

Key steps in the Cisco switch configuration included:

- Creation of VLANs: VLANs were created to logically segment the network, allowing for better control of network traffic.
- Port Assignment: Each port on the switch was assigned to a specific VLAN, ensuring that devices were placed in appropriate network segments.
- QoS Configuration: Quality of Service settings were configured to prioritize traffic based on specific criteria such as voice over IP (VoIP) or video streaming, ensuring that critical applications received sufficient bandwidth.

3.7.2 MikroTik Router Configuration

The MikroTik router configuration followed, with a focus on establishing secure and efficient routing protocols. Static routes were configured to enable seamless communication between different network segments. Firewall rules were implemented to safeguard the network against unauthorized access, while port forwarding was set up to redirect incoming traffic to the NAS system's fixed IP address.

Key steps in the MikroTik router configuration included:

- Static Routing: Static routes were configured to ensure that data packets could travel efficiently between different segments of the network.
- Firewall Rules: Firewall rules were put in place to control and monitor incoming and outgoing traffic, enhancing network security.
- Port Forwarding: Port forwarding was configured to redirect external requests to the NAS system's fixed IP address, allowing remote access.

For LAN configuration, IP address assignments were managed through Dynamic Host Configuration Protocol (DHCP) to simplify device connectivity. A dedicated subnet was allocated for the NAS system, ensuring consistent communication and efficient data transfer between devices and the NAS.

The success of the configuration was gauged through thorough testing. Network connectivity, data transfer speeds, and NAS access through the fixed IP address were evaluated. Collaborative efforts among team members facilitated troubleshooting and fine-tuning of configurations.

Challenges encountered during the project included optimizing QoS settings for varying network loads, addressing IP conflicts, and ensuring seamless communication between different segments of the network. These challenges were surmounted through meticulous configuration adjustments and collaboration among team members.

The successful outcome of the project resulted in a robust network infrastructure, enabling efficient access to the NAS system through a fixed IP address. This accomplishment demonstrated the significance of effective network design and configuration in facilitating seamless data transfer, optimizing performance, and enhancing user experience.

3.7.3 PoE Access Point for Lab Wi-Fi

In addition to configuring the wired LAN infrastructure, an essential component of our network setup was the utilization of a PoE (Power over Ethernet) access

point to provide seamless Wi-Fi connectivity to the lab area. This wireless solution aimed to ensure that both wired and wireless users could access network resources efficiently.

The PoE access point was strategically positioned in the lab area, taking into consideration signal strength and coverage. This access point was chosen for its ability to receive power and data through a single Ethernet cable, simplifying installation and reducing cable clutter.

Key aspects of the PoE access point setup included:

- **Placement and Coverage**: The access point was strategically placed to provide optimal coverage to all lab users. Signal strength and coverage were fine-tuned to ensure a reliable Wi-Fi connection.
- **Security Configuration**: Security protocols such as WPA2-PSK (Wi-Fi Protected Access 2 - Pre-Shared Key) were implemented to safeguard the wireless network from unauthorized access.
- **Guest Network**: A separate guest network was established to allow visitors to access the internet while keeping them isolated from the internal network resources.
- **Quality of Service (QoS)**: QoS settings were applied to prioritize traffic on the wireless network, ensuring that critical applications received adequate bandwidth.

The introduction of Wi-Fi via the PoE access point significantly enhanced the flexibility and mobility of lab users. Whether working on laptops, tablets, or smartphones, all users could benefit from a fast and secure wireless connection within the lab environment.

The integration of the PoE access point seamlessly complemented the wired LAN infrastructure, providing a well-rounded networking solution for the lab. It allowed users to access network resources, including the NAS system, from both wired and wireless devices, contributing to the overall efficiency and productivity of the lab environment.

3.8 Terminating Cat6 Cables

The process of terminating Cat6 cables is a critical skill in networking and data communication installations. Proper termination ensures reliable and high-speed data transmission, making it a fundamental aspect of building robust network infrastructures. Termination involves the precise connection of connectors to Cat6 cables' twisted pairs, maintaining signal integrity and minimizing interference.

Terminating Cat6 cables follows industry-standard practices that have evolved to accommodate the demands of modern data networks. Emphasis is placed on maintaining proper cable twists within connectors to prevent signal degradation and crosstalk. Adherence to industry standards defines color codes and pin assignments for consistent terminations.

The process typically involves using a crimping tool to cut the cable and attach RJ45 connectors. These connectors securely seal off the individual wires within the cable, ensuring a reliable and secure connection. After crimping, a pair of RJ45

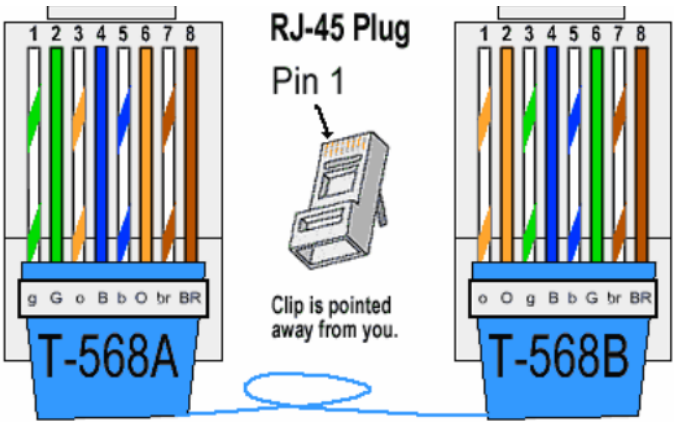

Figure 3.1: Terminating Cat6 Cable

cable testers is employed to confirm a proper connection through the cable before connecting computers or devices to the network switch.

Terminating Cat6 cables requires specific tools and techniques to achieve optimal results. The use of high-quality cable strippers, crimpers, and testers ensures accurate terminations and efficient troubleshooting. Cable testing post-termination to verify continuity and signal quality is essential, ensuring that the cable is ready for deployment.

Moreover, the termination process necessitates attention to detail, precision, and familiarity with the Cat6 cable's structure. Stripping the cable's jacket, untwisting the pairs, aligning the conductors, and crimping the connector are sequential steps that demand meticulous execution.

In summary, the termination of Cat6 cables is a foundational skill for establishing reliable and high-performance network connections. Adherence to industry standards, utilization of proper tools, and meticulous execution, including the use of crimping tools, RJ45 connectors, and cable testers, are vital components of successful terminations that facilitate efficient data transmission and minimal signal interference.

3.9 Exploring Connecting the NAS to the Internet

This section delves into an intriguing project undertaken during the internship – the exploration of connecting the Network-Attached Storage (NAS) system to the internet. The primary objective was to investigate the feasibility, security implications, and potential benefits of making the NAS accessible remotely over the internet and create a local hosted cloud where users can access their files from anywhere.

3.9.1 Project Goals

The project's main goals included:

- Assessing the technical requirements for internet connectivity of the NAS.
- Evaluating the security considerations associated with remote access.

- Exploring the advantages and use cases of having remote access to the NAS.

3.9.2 Technical Exploration

The project initiated with a comprehensive technical exploration of the NAS system and its compatibility with internet connectivity. This involved:

- Examining the NAS's network capabilities and available ports.
- Researching secure protocols and encryption methods for remote access.
- Assessing the hardware and software prerequisites for internet connectivity.

3.9.3 Exploring Remote Access Solutions

Initially, we attempted to use a load balancer service from freeloadbalancer.com to forward our Nextcloud server through the internet. However, full control required a monthly subscription fee, which was not in line with our project's objectives.

Subsequently, we explored the option of DNS port forwarding over a MikroTik router to a free domain name provided by noip.com. While this approach appeared promising, we encountered technical challenges that prevented us from establishing the connection.

3.9.4 Technical Challenges and Learning

The project became a valuable learning journey about network firewalls and network administration. Challenges included:

- The complexities of load balancer configurations.
- The technical intricacies of DNS port forwarding.
- The need for a deeper understanding of network security and administration.

3.9.5 Outcome

Despite the initial attempts, we ultimately decided to host the Nextcloud server locally due to the technical complexities and subscription costs associated with external services. This local setup allowed for convenient access within the organization's network, although it limited remote accessibility.

In conclusion, the project provided valuable insights into network administration, security, and remote access solutions. While we did not achieve our initial goal of connecting the NAS to the internet, the experience gained contributes to our understanding of network complexities and informs future decision-making regarding remote access solutions.

3.10 3D Design of a Computer Case

This section highlights a hands-on and creative project undertaken during the internship – the design of a computer case using two distinct software tools, Fusion 360

and Blender. The primary objective was to leverage the capabilities of both software platforms to conceptualize, model, and refine a unique computer case design that places a strong emphasis on functionality, aesthetics, and manufacturability.

3.10.1 Project Initiation

The design journey commenced with the utilization of Autodesk Fusion 360, a robust parametric modeling tool. Initial sketches and design concepts were transformed into a digital format, allowing for dynamic adjustments and iterative refinement. The parametric nature of Fusion 360 facilitated the exploration of various design elements, including dimensions, angles, and features, all while ensuring a consistent and coherent design.

3.10.2 Enhancing Aesthetics in Blender

Once the foundational design was established in Fusion 360, the project transitioned to Blender, a powerful 3D modeling and animation software. Blender's versatile toolset enabled the addition of intricate details, textures, and surface finishes that significantly contributed to the computer case's visual appeal. The non-linear workflow of Blender allowed for artistic freedom in refining the aesthetics and adding fine details to the design.

3.10.3 Overcoming Challenges

Throughout the design process, several challenges were encountered. These challenges included optimizing the design for manufacturability, ensuring proper ventilation, and maintaining structural integrity. Addressing these challenges required meticulous design adjustments, creative problem-solving, and collaborative consultation with mentors and peers.

3.10.4 Iterative Refinement

The iterative nature of the design process involved multiple rounds of feedback and refinement. Collaborative efforts were invested in critiquing and enhancing the design to meet both functional and visual objectives. The utilization of both Fusion 360 and Blender proved to be instrumental in visualizing and effectively communicating design concepts.

3.10.5 Successful Outcome

The project culminated in the creation of a comprehensive and visually appealing hexagon computer case design. The integration of Fusion 360's parametric capabilities and Blender's artistic freedom resulted in a design that elegantly balances functionality and aesthetics. This project underscores the significance of leveraging diverse software tools to transform creative visions into tangible and refined designs.

This hands-on experience in 3D design not only expanded technical skills but also provided valuable insights into the intersection of art and engineering within the context of product design.

3.11 Manufacturing at Motiv

The exploration of manufacturing practices during the internship provided valuable insights into the real-world application of innovative design and production methodologies. Manufacturing was conducted at GNEX, which is hosted at Motiv due to the availability of advanced machinery such as laser cutters, 3D printers, and woodworking machines located at Motiv.

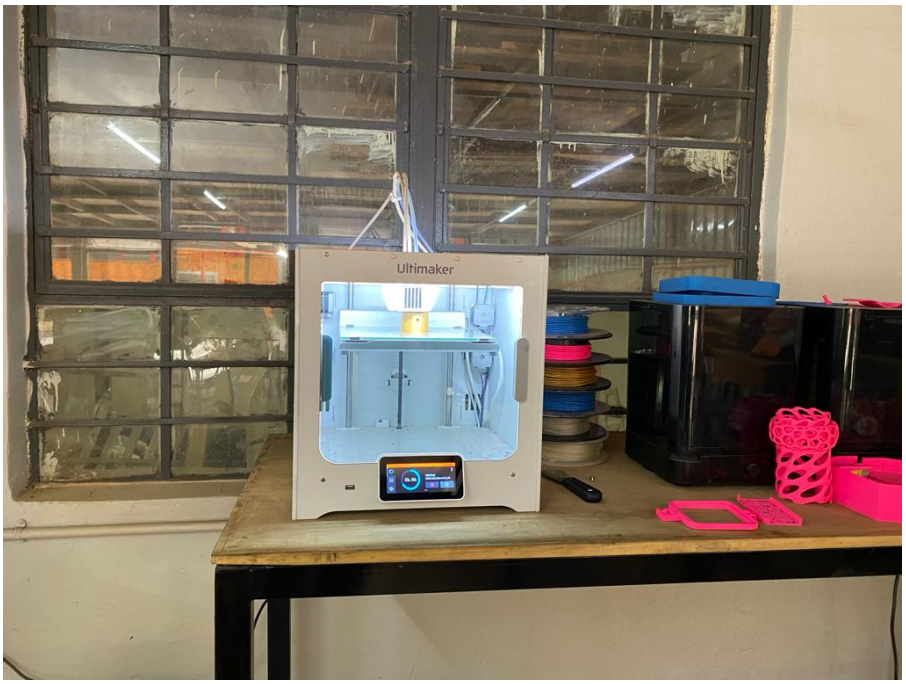

Figure 3.2: 3D Printer at Motiv

Figure 3.3: Wood thickener at Motiv

Motiv, a prominent player in the technology industry, is committed to cutting-edge

technology and sustainability, as exemplified by its adoption of advanced manufacturing techniques and materials. These practices align with the principles of Industry 4.0, characterized by the integration of digital technologies, automation, and data-driven decision-making into manufacturing operations. This approach streamlines production, enhances product quality, and reduces time-to-market.

Moreover, Motiv places a strong emphasis on sustainability and eco-conscious manufacturing practices, consistent with contemporary trends in corporate responsibility. By incorporating recycled and environmentally friendly materials, Motiv contributes to the reduction of carbon footprint and resource depletion.

Figure 3.4: Motiv's Advanced Manufacturing Facility

Motiv's commitment to lean manufacturing principles also merits attention. The application of lean methodologies, as observed at GNEX within the Motiv premises, optimizes resource utilization, eliminates waste, and enhances overall operational efficiency.

In conclusion, an in-depth analysis of manufacturing practices at GNEX hosted at Motiv underscores the integration of technology, sustainability, and lean methodologies to drive innovation in the technology industry. The adoption of Industry 4.0 principles, eco-conscious materials, and lean manufacturing techniques positions Motiv as a trailblazer in modern manufacturing practices.

3.12 Configuring a Gaming Server with Dual GPUs, Dual Motherboards, and Dual Power Supplies

This subsection outlines a complex and technically intricate project undertaken during the internship – the configuration of a gaming server that utilizes dual GPUs, dual motherboards, and dual power supplies, all powered by a single CPU. The objective was to harness the computing power of the system to deliver optimal gaming performance and handle resource-intensive tasks.

3.12.1 Project Initiation

The project commenced with meticulous hardware selection, ensuring compatibility and performance optimization. Two high-performance GPUs were chosen to cater to the demands of modern gaming and graphics-intensive applications. Dual

motherboards facilitated the management of resources and expansion possibilities, while two power supplies were implemented to distribute power efficiently. The utilization of a single CPU was a unique design choice that required creative solutions to ensure compatibility and stability.

3.12.2 Configuration Process

The configuration process involved rigorous cable management to ensure optimal airflow, thermal performance, and system stability. BIOS settings were fine-tuned to enable proper recognition of components and to maximize the utilization of resources.

3.12.3 Testing and Optimization

During the testing phase, benchmarking software and stress tests were employed to evaluate the system's stability, cooling efficiency, and gaming performance. Collaborative efforts within the team facilitated troubleshooting and optimization, ensuring that the server could deliver consistent and reliable performance.

3.12.4 Challenges and Solutions

Challenges faced during the project included running a 13-year-old CPU with a three-year-old GPU, which required creative solutions to balance performance and compatibility. Additionally, there were issues with mismatched grounds between the two motherboards, requiring meticulous electrical adjustments and grounding solutions. These challenges were addressed through a combination of technical expertise and collaborative problem-solving.

3.12.5 Project Outcome

The successful outcome of the project was the establishment of a high-performance gaming server that leveraged dual GPUs, dual motherboards, dual power supplies, and a single CPU. The configuration demonstrated the integration of cutting-edge hardware to deliver an immersive and seamless gaming experience. Additionally, the project showcased the complexity of managing resources, power, and cooling in a multi-component system.

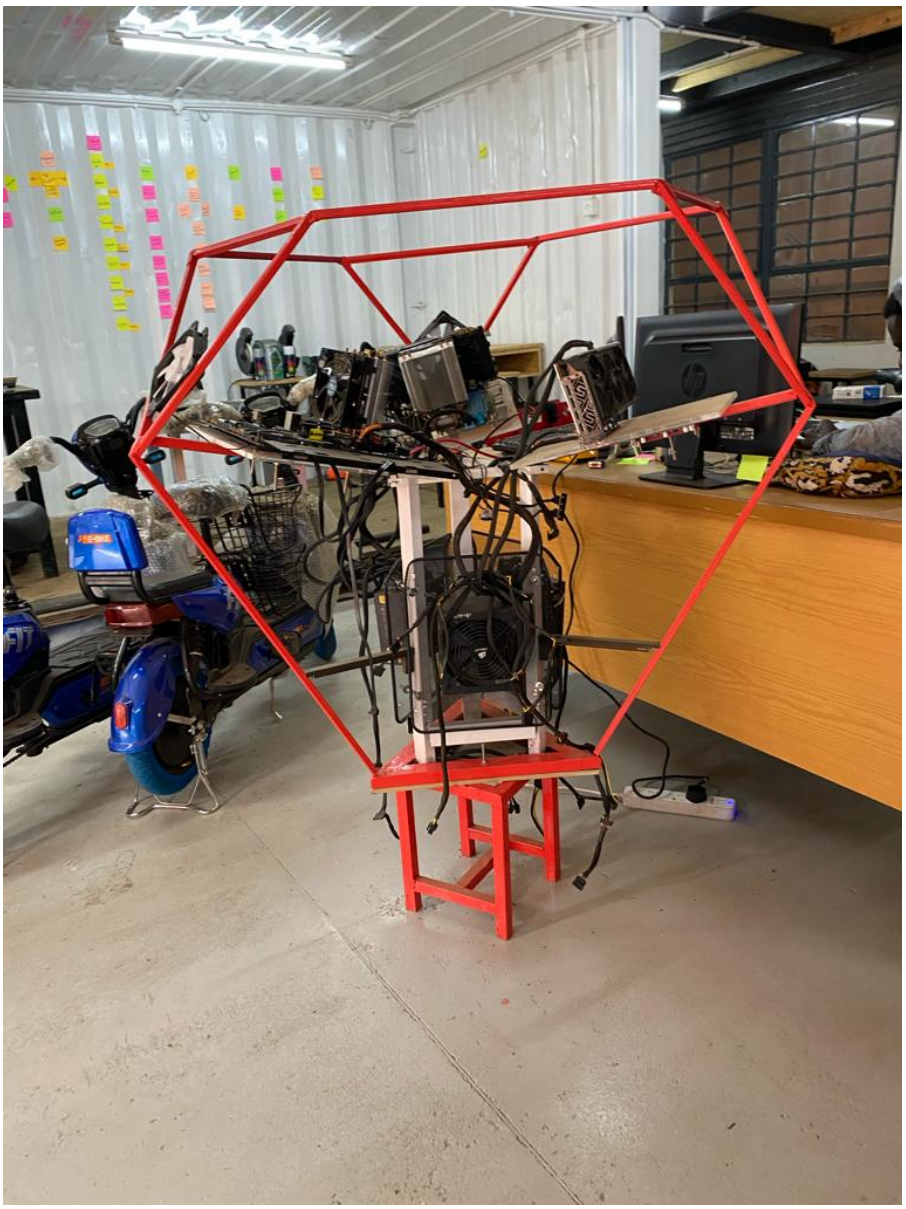

Figure 3.5: Gaming Server with Dual GPUs, Dual Motherboards, and Dual Power Supplies

3.13 Summary

In culmination, the internship has been a transformative and multifaceted experience that has provided a comprehensive understanding of various aspects of the field. Through a diverse array of projects, ranging from technical configurations to innovative designs, the internship has imparted invaluable skills, insights, and collaborative aptitude.

The project involving the configuration of a gaming server stands as a testament to the intricate nature of hardware integration and resource management. By configuring dual GPUs, dual motherboards, dual power supplies, and a single CPU, the project highlighted the complexities of orchestrating high-performance computing systems while optimizing power and cooling considerations. The process underscored the significance of meticulous hardware selection, fine-tuning BIOS settings, and rigorous stress testing to ensure stability and consistent performance.

The amalgamation of Autodesk Fusion 360 and Blender for the design of a computer case exhibited the dynamic interplay between parametric modeling precision and artistic expression. The creative journey of transforming initial sketches into a refined digital prototype showcased the power of iterative design, culminating in a harmonious balance between aesthetics and functionality.

Furthermore, the network configuration project involving a Cisco switch, MikroTik router, and LAN underscored the pivotal role of seamless connectivity in facilitating efficient data access to the NAS system. By meticulously configuring VLANs, routing protocols, and firewall rules, the project demonstrated the ability to create a robust and secure network infrastructure that enhances data transfer speed and accessibility.

The creation of a Nextcloud server with plugins within the TrueNAS CORE environment exemplified the significance of integrative solutions in catering to diverse user needs. The incorporation of supplementary plugins for encryption, backup, and monitoring showcased the adaptability of the system to accommodate an array of functionalities, augmenting both security and user experience.

The utilization of e-waste components for the construction of a TrueNAS server presented an innovative and sustainable approach to technology utilization. By repurposing discarded electronic components, the project embodied ethical e-waste management practices while contributing to the organization's environmental initiatives.

Collectively, these projects have cultivated a multifaceted skill set that encompasses technical prowess, creative problem-solving, collaboration, and adaptability. As the internship concludes, the gained knowledge and experiences will undoubtedly serve as the foundation for continued growth and success in the dynamic realm of technology.

Chapter 4

Conclusions

4.1 Conclusion

The internship experience has been a remarkable journey of growth, learning, and practical application. Through hands-on projects spanning diverse areas of technology, this internship has provided a platform to bridge the gap between theoretical knowledge and real-world implementation.

The culmination of these projects underscores the significance of adaptability and innovation in a dynamic technological landscape. The configuration of a gaming server with dual GPUs, dual motherboards, dual power supplies, and a single CPU showcased the intricacies of advanced hardware integration, while the 3D design of a computer case using Fusion 360 and Blender highlighted the intersection of precision and creativity. The successful network configuration emphasizing seamless NAS access and the establishment of a Nextcloud server with plugins underscored the role of integrative solutions in modern data management.

Moreover, the utilization of e-waste components for the construction of a TrueNAS server highlighted the importance of sustainable practices and resourcefulness in technology projects. The endeavor to build a personal computer from repurposed e-waste showcases the potential of responsible utilization in both personal and professional contexts.

4.2 Recommendations

Based on the experiences and insights gained during the internship, several recommendations are put forth to further enhance future projects, skill development, and organizational initiatives:

4.2.1 Continuous Skill Enhancement

The ever-evolving nature of technology demands continuous skill development. It is recommended to actively engage in self-directed learning, online courses, and workshops to stay updated with the latest trends and advancements in the field. Collaborating with peers, sharing knowledge, and seeking guidance from mentors can contribute to well-rounded growth.

4.2.2 Exploration of Emerging Technologies

Exploring emerging technologies such as artificial intelligence, blockchain, and Internet of Things (IoT) can broaden horizons and open doors to new opportunities. Engaging in projects related to these domains can foster innovation and provide a competitive edge in an increasingly technology-driven landscape.

4.2.3 Interdisciplinary Collaboration

Collaborating across disciplines can lead to novel solutions and perspectives. Engaging with professionals from different backgrounds can provide fresh insights and encourage innovative problem-solving. This collaborative approach can be especially valuable when tackling complex projects that require diverse expertise.

4.2.4 Environmentally Responsible Practices

The project involving the utilization of e-waste for building computer systems highlighted the importance of environmentally responsible practices. Expanding these initiatives to include recycling, repurposing, and sustainable technology solutions aligns with the organization's commitment to reducing electronic waste and minimizing environmental impact.

4.2.5 Documentation and Knowledge Sharing

Comprehensive documentation of projects, methodologies, challenges, and solutions can serve as a valuable resource for future endeavors. Regularly updating documentation and sharing knowledge within the team can facilitate smoother project transitions and support ongoing maintenance.

4.2.6 Soft Skills Development

While technical skills are crucial, honing soft skills such as communication, teamwork, and adaptability is equally vital. Engaging in public speaking, networking, and leadership opportunities can contribute to a well-rounded skill set that is highly valued in the professional world.

Incorporating these recommendations can further elevate the quality of work, personal growth, and contributions to the field of technology. The internship has provided a solid foundation, and embracing these suggestions can pave the way for continued success.

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