**KOH KARLSON NGUM**

**LANDMARK METROPOLITAN UNIVERSITY**

**Internship Report**

**Title: Accelerating Software Delivery**

**A DevOps Internship Experience at Landmark Technology**

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**CERTIFICATION**

I, KOH KARLSON, hereby certify that this internship report titled "ACCELERATING SOFTWARE DELIVERY" represents my own work and is based on my personal experiences and observations during my internship at Landmark Technology. All information and data presented in this report are true and accurate to the best of my knowledge.

I further affirm that this report has not been submitted in part or in whole for any other purpose or qualification.

KOH KARLSON NGUM

Matricule N0

30 September 2023

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**DEDICATION**

This report is dedicated to:

- My loving family, whose unwavering belief in me has been my constant motivation and support throughout my journey. Thank you for always being there for me.

- My internship mentor, whose expertise and guidance have played a pivotal role in shaping my understanding of DevOps engineering. Thank you for your patience, valuable insights, and continuous support throughout my internship journey.

- My friends and colleagues, whose camaraderie, collaboration, and shared learning have made my internship experience truly memorable. Thank you for being an incredible support system.

- The vibrant and passionate DevOps community, whose collective knowledge, open-source contributions, and continuous strive for innovation have inspired me to pursue excellence in DevOps engineering. Thank you for pushing the boundaries and driving the industry forward.

KOH KARLSON NGUM

30 September 2023

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**ACKNOWLEDGEMENTS**

I would like to express my deepest gratitude to the following individuals and organizations who have contributed to my internship experience at Landmark Technology:

My Team:

I am immensely grateful to my team members at Landmark Technology for their support, collaboration, and guidance throughout my internship. Their expertise, camaraderie, and willingness to share knowledge have enriched my learning experience and made me feel like a valued member of the team.

Internship Mentor:

I extend my heartfelt appreciation to my dedicated internship mentor for providing me with valuable guidance, feedback, and mentorship throughout my internship. Their expertise and willingness to invest time and effort in my professional growth have been instrumental in my development as a DevOps engineer.

Supervisor and Management:

I would like to thank my supervisor and the management team at Landmark Technology for providing me with this valuable opportunity and fostering a supportive work environment. Their trust, guidance, and encouragement have allowed me to explore and apply my skills in a real-world setting.

Family and Friends:

I would like to express my heartfelt appreciation to my family and friends for their unwavering support, encouragement, and understanding throughout my internship journey. Their love, belief in my abilities, and motivation have been instrumental in my success.

I am also thankful to all other individuals, colleagues, and mentors who have directly or indirectly contributed to my internship experience.

KOH KARLSON NGUM

30 September 2023

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**EXECUTIVE SUMMARY**

This internship report provides a comprehensive overview of my journey and experiences in the field of DevOps engineering during my internship at Landmark Technology. The main objective of my internship was to explore and gain proficiency in various DevOps tools and technologies, with a focus on Linux commands, Bash shell scripting, Apache Maven, SonarQube, Nexus, Apache Tomcat, Jenkins, AWS services, Git, and GitHub.

Throughout the internship, I acquired in-depth knowledge and hands-on experience in using Git for version control and GitHub as a repository service. Git, a distributed version control system, enabled me to track changes, collaborate with team members, and manage software versions efficiently. I learned essential Git commands, such as initializing a repository, creating branches, committing changes, and merging branches. This knowledge empowered me to contribute effectively to collaborative software development projects and maintain a well-documented history of code changes.

Additionally, I leveraged GitHub as a repository service to host and manage my codebase. GitHub's user-friendly interface and powerful collaboration features facilitated seamless code sharing, code reviews, and issue tracking. I learned how to create repositories, clone remote repositories locally, push changes to remote repositories, and collaborate with team members using pull requests. GitHub's integration with other DevOps tools, such as Jenkins, also enabled me to automate build and deployment processes triggered by code changes.

In conjunction with Git and GitHub, I explored a wide range of other DevOps tools and technologies. I gained proficiency in Linux commands and Bash shell scripting, allowing me to navigate and manage Linux-based systems effectively. Apache Maven served as a valuable build automation and dependency management tool, streamlining the software build process and ensuring consistent project structure. SonarQube and Nexus enabled me to analyze code quality metrics, identify potential issues, and manage software artifacts to ensure code reliability and continuous improvement. Apache Tomcat empowered me to install, configure, and deploy web applications in a production environment.

Furthermore, Jenkins played a pivotal role in automating and orchestrating the DevOps workflow. I configured Jenkins to automate software builds, integrate various tools and technologies, and establish continuous integration and deployment pipelines. Additionally, I explored various AWS services, such as EC2, S3, RDS, and Lambda, to leverage cloud-based infrastructure and services for scalable and reliable application deployment.

Throughout the internship, I actively engaged in team meetings, code reviews, and collaborative projects, fostering effective communication and teamwork skills. I also delved into containerization technologies, specifically Docker, and learned about infrastructure as code (IaC) principles using tools like Ansible. Monitoring and observability tools like Prometheus and Grafana helped me gain real-time visibility into application performance.

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This report provides detailed accounts of my experiences studying and working with these technologies, discussing the challenges faced, lessons learned, and the impact they have on the DevOps landscape. Overall, this internship has equipped me with a comprehensive skill set and a deep understanding of DevOps principles and practices, emphasizing the importance of automation, collaboration, and continuous improvement in software development and delivery.

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**CHAPTER I**

**GENERAL INTRODUCTION**

The field of DevOps engineering has emerged as a pivotal discipline in the software development industry, revolutionizing the way organizations deliver software through enhanced collaboration, streamlined workflows, and continuous integration and delivery. This internship report documents my journey and experiences at Landmark Technology, where I had the invaluable opportunity to delve into various DevOps tools and technologies and gain practical expertise in the field.

Throughout the internship, I focused on studying and mastering a comprehensive set of DevOps tools and technologies, including Linux commands, Bash shell scripting, Apache Maven, SonarQube, Nexus, Apache Tomcat, Jenkins, AWS services, Git, and GitHub. These tools formed the foundation of my exploration, enabling me to tackle critical aspects of the DevOps ecosystem.

One of the fundamental components of modern software development is version control, and for this purpose, I extensively utilized Git, a distributed version control system. Git empowered me to track changes, collaborate with team members, and manage software versions efficiently. I gained proficiency in essential Git commands, enabling me to initialize repositories, create branches, commit changes, and merge branches seamlessly. This knowledge played a crucial role in maintaining a well-documented history of code changes and facilitating effective collaboration with fellow developers.

To complement Git, I leveraged GitHub as a repository service, providing a centralized platform for hosting and managing my codebase. GitHub's intuitive interface and robust collaboration features facilitated seamless code sharing, code reviews, and issue tracking among team members. I became adept at creating repositories, cloning remote repositories locally, pushing changes to remote repositories, and leveraging the power of pull requests to foster efficient collaboration. GitHub's integration with other DevOps tools, such as Jenkins, enhanced my ability to automate build and deployment processes triggered by code changes.

In addition to Git and GitHub, my internship journey encompassed a wide range of other DevOps tools and technologies. I delved into Linux commands and Bash shell scripting, equipping myself with the skills to navigate and manage Linux-based systems effectively. Apache Maven served as a valuable build automation and dependency management tool, streamlining the software build process and ensuring project consistency. SonarQube and Nexus empowered me to analyze code quality metrics, identify potential issues, and manage software artifacts to drive code reliability and continuous improvement. Apache Tomcat enabled me to install, configure, and deploy web applications in a production environment, while Jenkins facilitated automation and orchestration of the DevOps workflow.

Furthermore, I explored various AWS services, such as EC2, S3, RDS, and Lambda, to harness cloud-based infrastructure and services for scalable and reliable application deployment. I gained insights into containerization technologies, specifically Docker, and the principles of infrastructure as code (IaC) using tools like Ansible and Puppet. Monitoring and observability tools like Prometheus and Grafana allowed me to gain real-time visibility into application performance, ensuring optimal operational efficiency.

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Throughout my internship, I actively engaged in team meetings, code reviews, and collaborative projects, fostering effective communication and teamwork skills. This experience highlighted the significance of collaboration and cross-functional cooperation in bridging the gap between development and operations teams, further reinforcing the core principles of DevOps.

In the following sections of this report, I will provide detailed accounts of my experiences studying and working with these technologies, discussing the challenges faced, lessons learned, and the impact they have on modern software development practices. The report aims to provide a comprehensive understanding of the DevOps landscape and the key tools and technologies that drive efficient software delivery in today's dynamic industry.

**2**

**1.1**

**OBJECTIVES AND GOALS**

The objective of this internship was to gain practical expertise in the field of DevOps engineering and acquire proficiency in a comprehensive set of DevOps tools and technologies. The internship aimed to provide hands-on experience in implementing DevOps practices, fostering collaboration, and automating software development and delivery processes. By the end of the internship, the goal was to have a deep understanding of DevOps principles and practices, and the ability to contribute effectively to modern software development projects.

**goals**

**Git and GitHub Proficiency:** Gain proficiency in Git for version control and GitHub as a repository service. Learn essential Git commands, such as initializing repositories, creating branches, committing changes, and merging branches. Utilize GitHub as a repository service to host and manage the codebase, enabling seamless code sharing, code reviews, and issue tracking. Develop skills in collaborative code management and version control.

**DevOps Toolchain Mastery:** Explore and master a range of DevOps tools and technologies such as Linux commands, Bash shell scripting, Apache Maven, SonarQube, Nexus, Apache Tomcat, Jenkins, and AWS services. Develop competency in Linux commands and Bash scripting for efficient system management. Utilize Apache Maven for build automation and dependency management. Harness SonarQube and Nexus for code quality analysis and artifact management. Install, configure, and deploy web applications using Apache Tomcat. Configure and automate workflows using Jenkins. Leverage AWS services for scalable and reliable application deployment.

**Infrastructure as Code and Configuration Management:** Understand the principles of infrastructure as code (IaC) and gain proficiency in tools like Ansible for automated infrastructure provisioning and configuration. Learn how to define infrastructure and configuration in code, enabling consistent and reproducible deployments.

**Containerization and Deployment:** Gain insight into containerization technologies, specifically Docker, for lightweight and portable application deployment. Learn how to create and manage containers, and understand the benefits of containerization for scalability and environment consistency.

**Monitoring and Observability:** Develop skills in monitoring and observability using tools like Prometheus and Grafana. Learn how to set up monitoring systems, collect metrics, and visualize data to gain real-time visibility into application performance and infrastructure health. Understand the importance of proactive monitoring for identifying and resolving issues quickly.

**Communication and Teamwork:** Foster effective communication and teamwork skills through active participation in team meetings, code reviews, and collaborative projects. Understand the importance of collaboration and cross-functional cooperation in bridging the gap between development and operations teams. Learn how to effectively communicate ideas, share knowledge, and work together towards common goals.

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**Automation and Continuous Delivery:** Apply DevOps principles and practices to automate software development and delivery processes. Learn how to set up continuous integration and continuous delivery (CI/CD) pipelines using tools like Jenkins. Automate build, test, and deployment processes to enable faster and more reliable software delivery.

**Continuous Learning and Improvement:** Embrace a culture of continuous learning and improvement in the DevOps field. Stay updated with the latest trends and technologies through self-study, research, and participation in relevant communities. Strive to enhance skills and knowledge to adapt to the evolving landscape of DevOps.

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**1.2**

**IMPORTANCE/SIGNIFICANCE OF THIS INTERNSHIP**

**Practical Application of Knowledge:** The internship provided an invaluable opportunity to apply theoretical knowledge gained throughout your software engineering studies into real-world scenarios. It allowed you to bridge the gap between academia and industry by experiencing firsthand how software development and DevOps principles are implemented in a professional setting.

**Industry Exposure and Insight:** The internship exposed you to the realities and challenges of the software development industry. It provided a deeper understanding of industry practices, standards, and workflows, giving you insights into how software engineering principles are applied in real projects.

**Professional Skill Development:** The internship facilitated the development of essential professional skills that are highly sought after in the software engineering field. These skills include effective communication, teamwork, problem-solving, time management, adaptability, and the ability to work in a fast-paced environment. The practical experiences gained during the internship helped enhance and refine these skills.

**Technical Skill Enhancement:** The internship allowed you to gain hands-on experience with a range of DevOps tools and technologies, enabling you to enhance your technical skill set. This practical exposure helped you gain proficiency in tools such as Git, GitHub, Linux commands, Bash scripting, Apache Maven, SonarQube, Nexus, Apache Tomcat, Jenkins, and AWS services. These skills are highly valuable in the software engineering industry and can significantly enhance your employability.

**Networking Opportunities:** Through the internship, you had the chance to network and collaborate with professionals in the software development field. Building connections with industry experts, fellow interns, and mentors can open doors to future career opportunities, provide valuable guidance, and foster professional growth.

**Insight into DevOps Practices:** The internship offered an in-depth understanding of DevOps practices and their significance in modern software development. You gained exposure to concepts such as continuous integration, continuous delivery, version control, automated testing, infrastructure as code, and monitoring. This knowledge equips you with a holistic perspective on software development, emphasizing collaboration, efficiency, and quality.

**Resume Enhancement:** Completing a successful internship at a reputable organization like Landmark Technology can significantly strengthen your resume and increase your marketability to potential employers. It demonstrates your practical experience, industry exposure, and the ability to apply theoretical knowledge in real-world scenarios.

**Self-Reflection and Future Growth:** The internship provided an opportunity for self-reflection and personal growth. You were able to identify strengths, weaknesses, and areas for improvement in your technical and professional skills. This self-awareness allows you to focus on personal and career development, setting a foundation for continuous learning and improvement in the software engineering field.

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**CHAPTER II**

**PRESENTATION OF THE ORGANISATION**

**2.1 Historical Background Of The Organisation**

LANDMARK Metropolitan University has a rich historical background that traces its origins back to Legacy International College of Arts and Sciences (LICAS). LICAS was established in 2005 as the foundation of LANDMARK. Initially, LICAS focused on providing arts and sciences education.

In 2013, LICAS transformed into LANDMARK Higher Institute (LHI) and began offering Cameroon national programs such as the Higher National Diploma (HND) and Higher Professional Diploma (HPD). During this time, LANDMARK achieved notable success, including producing the Best ABE (Association of Business Executives) student in the world. This recognition brought pride to Africa and solidified LANDMARK's reputation as "The Pride of Africa."

Under the visionary leadership of the President of LANDMARK Metropolitan University, the institution expanded its reach. In 2019, after exceptional performance by students in the Cameroon HND session results, LANDMARK Technology established campuses in Canada (Toronto) and the USA (New York). Furthermore, LANDMARK Metropolitan University produced the Best student in the Engineering and Technology department in the entire Republic of Cameroon. It also celebrated having the top three best students from the South West Region.

In 2021, the President of LANDMARK launched The LANDMARK President's fully funded Scholarship Scheme. This scholarship was designed to support the best performing GCE Advance Level students and Internally Displaced Persons (IDPs) in Cameroon. The scholarship offered opportunities to study HND, BSc, and MSc degree programs in fields such as Computer Engineering, Software Engineering, and other related engineering disciplines. Twelve beneficiaries were awarded scholarships worth over twelve million FCFA, demonstrating LANDMARK's commitment to educational excellence and access.

In 2022, LANDMARK Metropolitan University continued to excel. The HND session results revealed that LANDMARK produced the Best students in Computer Graphics and Web Design across the Republic of Cameroon. In the same year, the institution embarked on new ventures, including the establishment of LANDMARK Constructions and Logistics Company. Additionally, construction of a second campus in Buea was initiated, showcasing LANDMARK's commitment to academic growth and infrastructure development.

Moreover, LANDMARK Technologies expanded its scope by accepting interns from other universities such as the University of Buea, CUIB (Catholic University Institute of Buea), and IUG Douala. This collaboration allowed students from diverse educational backgrounds to benefit from the practical experiences and opportunities provided by LANDMARK.

Overall, LANDMARK Metropolitan University has a history marked by continuous achievements, academic excellence, international expansion, and a commitment to empowering students through scholarships and practical training.

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**2.2 Aims And Objective Of The Organisation**

**Academic Excellence:** To provide a high-quality education and training in the field of technology, with a focus on computer engineering, software engineering, and related disciplines. The aim is to equip students with the knowledge, skills, and competencies necessary to excel in the rapidly evolving technology industry.

**International Expansion and Collaboration:** To expand the reach and influence of Landmark Technology by establishing campuses and collaborations beyond Cameroon. The objective is to create global opportunities for students, foster international partnerships, and promote cross-cultural learning experiences.

**Scholarship and Access:** To promote educational access and inclusivity by offering fully funded scholarships to high-achieving GCE Advance Level students and Internally Displaced Persons (IDPs) in Cameroon. The aim is to provide deserving individuals with the opportunity to pursue HND, BSc, and MSc degree programs in technology-related fields, regardless of their financial circumstances.

**Industry-Relevant Curriculum:** To develop and deliver a curriculum that is aligned with industry demands and trends. The objective is to ensure that students acquire the necessary technical skills, problem-solving abilities, and practical experience to thrive in the technology sector. This includes incorporating emerging technologies and industry best practices into the curriculum.

**Practical Training and Internship Programs:** To offer practical training opportunities and internship programs to students from Landmark Technology as well as other universities. The aim is to bridge the gap between academia and industry by providing students with hands-on experience, exposure to real-world projects, and the opportunity to apply their theoretical knowledge in practical settings.

**Multidisciplinary Collaboration:** To promote collaboration and interdisciplinary learning by encouraging students from different educational backgrounds to join Landmark Technology as interns. The objective is to create a diverse and inclusive learning environment where students can exchange ideas, share knowledge, and benefit from different perspectives.

**Infrastructure Development:** To support the growth and development of Landmark Technology by investing in state-of-the-art infrastructure and facilities. The aim is to create an environment conducive to learning, research, and innovation, providing students with access to modern technology tools and resources.

**Continuous Improvement and Innovation:** To foster a culture of continuous improvement, innovation, and research within Landmark Technology. The objective is to encourage faculty and students to stay updated with the latest advancements in technology, explore new ideas, and contribute to the development of the field through research and innovation projects.

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**Graduate Employability:** To enhance the employability of graduates by equipping them with the necessary technical and soft skills demanded by the technology industry. The aim is to prepare students for successful careers by providing career guidance, industry connections, and opportunities for professional development.

By striving to achieve these aims and objectives, Landmark Technology aims to be at the forefront of technology education, producing skilled and competent graduates who can contribute to the advancement of the technology industry locally and globally.

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**2.3 Products Offered By The Organisation**

**DevOps Training:** Landmark Technology offers comprehensive DevOps training programs. These programs equip students with the knowledge, skills, and practical experience needed to implement DevOps principles and practices in software development. The training covers areas such as continuous integration, continuous delivery, version control, automated testing, infrastructure as code, and monitoring.

**Full Cloud Computing Training (AWS):** Landmark Technology provides in-depth training in cloud computing, with a specific focus on Amazon Web Services (AWS). The training programs offer hands-on experience in utilizing AWS services, such as Amazon EC2, Amazon S3, Amazon RDS, AWS Lambda, and AWS CloudFormation. Students learn how to design, deploy, and manage cloud-based solutions, enabling them to leverage the power of cloud computing in their careers.

**IT Services:** Landmark Technology offers a range of IT services to clients. These services encompass various aspects of technology, including software development, system administration, network management, and technical support. The organization leverages its expertise in software engineering and cloud computing to deliver solutions that meet the specific needs of clients, helping them optimize their IT infrastructure and achieve their business objectives.

By offering DevOps and cloud computing training, as well as providing IT services, Landmark Technology caters to the growing demand for skilled professionals in these fields. The training programs enable individuals to enhance their knowledge and capabilities, while the IT services support businesses in leveraging technology to drive efficiency, innovation, and growth.

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**2.4 Organisational Structure**

**1. President/CEO:**

* Provides overall leadership and strategic direction for Landmark Technology.
* Oversees the implementation of organizational goals and objectives.
* Represents the organization in external partnerships and collaborations.

**2. Vice President/Chief Technology Officer (CTO):**

* Leads the technology department and ensures alignment with the organization's vision.
* Sets the technology strategy and roadmap for Landmark Technology.
* Oversees research and development efforts, keeping up-to-date with emerging technologies.
* Collaborates with other departments to drive innovation and technological advancements.

**3. Human Resources:**

* Manages all aspects of human resources, including recruitment, hiring, and employee development.
* Ensures compliance with labor laws, regulations, and organizational policies.
* Handles employee relations, performance management, and benefits administration.
* Facilitates training and development programs for employees.

**4. Academic Department:**

* Oversees the academic programs offered by Landmark Technology.
* Develops and updates the curriculum to align with industry standards.
* Recruits and manages faculty members, ensuring their qualifications and expertise.
* Monitors the quality of teaching and learning processes.
* Supports students' academic progress and provides guidance for their professional development.

**5. Technology Training and Certifications Department:**

* Manages the delivery of training programs in DevOps, cloud computing (AWS), and other technology-related areas.
* Designs and develops training materials and resources.
* Coordinates with trainers and instructors to ensure high-quality training delivery.
* Manages certification programs and partnerships with industry certification bodies.

**7. Research and Development Department:**

* Conducts research and development activities to drive innovation within Landmark Technology.
* Explores new technologies, methodologies, and best practices.
* Collaborates with industry partners, academic institutions, and research organizations.
* Supports faculty and students in research projects and initiatives.

**8. Administration and Finance:**

* Manages the financial operations and budgeting for Landmark Technology.
* Handles procurement, contracts, and vendor management.
* Provides administrative support to various departments.
* Ensures compliance with financial regulations and reporting requirements.

**9. Marketing and Communications:**

* Develops and implements marketing strategies to promote Landmark Technology's programs and services.
* Manages branding, advertising, and digital marketing initiatives.
* Coordinates internal and external communications, including website content, social media, and public relations.
* Engages with prospective students, industry partners, and stakeholders.

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