TECHNICAL REPORT ON STUDENT INDUSTRIAL WORK EXPERIENCE SCHEME(SIWES)

NIGERIAN NATIONAL PETROLEUM CORPORATION LIMITED(NNPC LTD)

AND

ITB NIGERIA LIMITED

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Computer Science | BHU/19/04/05/0084.

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This document contains detailed information about the organizations and activities undergone by the subject herein this document refers to over the course of the **SIX** months industrial training program submitted to the **FACULTY OF SCIENCE AND TECHNOLOGY, BINGHAM UNIVERSITY, ABUJA-KEFFI RD, NEW KARU. NIGERIA** as one of the prerequisites for the **BACHELOR OF SCIENCE (B.Sc.)** award in **COMPUTER SCIENCE.**

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DECLARATION

I (Anthony O. Adegbe), declare that this report has been carried out and belongs to me, except for extracts and summaries for which the original references are stated herein under the supervision of (Aliyu Yakubu Ibrahim).

Signature…….. **Date**……..

DEDICATION

This report is dedicated to all the wonderful individuals that contributed to my growth and experience during my period of attachment at the Nigerian National Petroleum Corporation Limited (NNPC LTD) and ITB Nigeria Limited and that also extends to my parents who played a crucial role and supported me throughout the whole program.

CERTIFICATION

This is to certify that this report was written by **ANTHONY O. ADEGBE** with matriculation number **BHU/19/04/05/0084** following the completion of the **SIX** months industrial training program **SIWES** under the supervision of **ALIYU YAKUBU IBRAHIM** in the department of **COMPUTER SCIENCE** under the **FACULTY OF SCIENCE AND TECHNOLOGY, BINGHAM UNIVERSITY, ABUJA-KEFFI RD, NEW KARU NIGERIA.**

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ACKNOWLEDGEMENT

Working for the Nigerian National Petroleum Corporation(NNPC) and the world class construction company ITB Nigeria was interesting. During these six months of SIWES internship I learnt a lot about my field in depth along with other fields that are applicable to it, and especially the application of Information Technology(IT) to companies and businesses irrespective of what they do.

I have to thank God Almighty for his protection, guidance and provision during the period of my SIWES Attachment.

I am grateful to my institutional based supervisor Mr.Aliyu Ibrahim, the HOD of the computer science department Dr. Ageebee Faki Silas, Mrs. Ann Bijik Hassan, and all other lecturers and staff of the department for providing the platform and environment to learn and also for their contributions to the success of another SIWES period.

ABSTRACT

This report focuses on experience gained in Cybersecurity, Vulnerability Assessment and Penetration Testing(VAPT) on a broad scale of systems and technologies, also techniques and concepts such as the penetration testing process and what it involves, such as scanning which involves looking at a system or service to find information, enumeration techniques which involves further investigation on select systems or services, exploitation techniques which involve compromising a service and also post exploitation techniques which involves what to do after compromise. It also focuses on Computer/Networking concepts and constructs such as hardware maintenance, troubleshooting, system troubleshooting, network creation and management.

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CHAPTER ONE

1.1 INTRODUCTION

This report is based on the practical and theoretical experience I gained during the 6 months' student's Industrial working experience scheme (SIWES), which I undertook at Nigerian National Petroleum Corporation Limited(NNPC LTD) and ITB NIGERIA LIMITED. The training covers a period of 6 months from March to September 2022. This report discusses the technical skills gained during the training period and justifies the relevance of the scheme in equipping students with the needed technical competence to thrive in the real world.

1.2 SIWES

Student Industrial Work Experience Scheme (SIWES) is a training program designed to expose and prepare students of Universities and other tertiary institutions such as Polytechnics, Colleges of Technology, Colleges of Agriculture and Education for an Industrial work situation which they are likely to meet after graduating. It provides the students of the above mentioned institutions to acquire practical skills and knowledge and prepares them for the workforce after graduation.

1.3 HISTORY OF SIWES

Student's Industrial Work Experience Scheme(SIWES) was established by Industrial Training Funds (ITF) in the year 1973 to solve the problem of lack of adequate proper skills for employment of tertiary institution graduates by Nigerian Industries. The Students' Industrial Work Experience Scheme (SIWES) was founded to be a skill training programme to help expose and prepare students of universities, polytechnics and colleges of education for the industrial work situation to be met after graduation. This scheme serves as a smooth transition from the classroom to the world of work and further helps in the application of knowledge. The scheme provides students with the opportunity of acquainting and exposing themselves to the experience required in handling and managing of equipment and machinery that are usually not made available in their institutions.

Before this scheme was established, there was a growing concern and trend noticed by industrialists that graduates of higher institutions lacked sufficient practical background for employment. It used to be that students who got into Nigerian institutions to study science and technology were not trained in the practical know-how of their various fields of study. As a result, they could not easily find jobs due to the lack of working experience.

Therefore, the employers thought that theoretical education going on in higher institutions was not responsive to the needs of the employers of labour. This was a huge problem for thousands of Nigerians until 1973. It is against this background that the fundamental reason for initiating and designing the scheme by the fund in 1973/74 was introduced.

The ITF organization (Industrial Training Fund) made a decision to help all interested Nigerian students and established the SIWES program. It was officially approved and presented by the Federal Government in 1974. The scheme was solely funded by the ITF during its formative years but as the financial involvement became unbearable to the fund, it withdrew from the scheme in 1978. In 1979, the federal government handed over the management of the scheme to both the National Universities Commission (NUC) and the National Board for Technical Education (NBTE).

Later, in November 1984, the federal government reverted the management and implementation of the scheme to ITF. In July 1985, it was taken over by the Industrial Training Fund (ITF) while the funding was solely borne by the federal government.

1.4 GENERAL OBJECTIVES OF SIWES

SIWES is strategized for skill acquisition. It is in fact designed to prepare and expose students of universities, polytechnics and colleges of education to the real-life work situation they would be engaged in after graduation. Therefore, SIWES is a key factor required to inject and help keep alive industrialization and economic development in the nation through the introduction and practical teaching of scientific and technological skills to students. (Culled from Detailed Manual on SIWES Guidelines and Operations for Tertiary Institutions). Objectives of the Students Industrial Work Experience Scheme include:

I. Provide an avenue for students to acquire industrial skills for experience during their course of study

II. Expose students to work methods and techniques that may not be available during their course of study.

III. Bridging the gap between theory and practice by providing a platform to apply knowledge learnt in school to real work situations

IV. Enabling the easier and smoother transition from school by equipping students' with better contact for future work placement

V. Introduce students to a real work atmosphere so that they know what they would most likely meet once they graduate.

1.5 IMPORTANCE OF SIWES

All Nigerian students who study technology and science must know about SIWES. Partaking in SIWES has become a prerequisite for the award of diploma and degree certificates in many Nigerian Institutions according to the Nigerian government Educational policy. Undergraduate students of the following disciplines are expected to be a part of the scheme: Natural sciences, Engineering and Technology, Education, Agriculture, Medical Sciences, Environmental, and pure and applied sciences. The duration is for four months and one year for polytechnics and colleges of education students respectively and six months for university students.

In addition to that, it equips students with the skills and resources needed to effectively break into the workforce as qualified individuals in their respected fields.

CHAPTER TWO

2.1 GENERAL OVERVIEW OF NNPC

Nigerian National Petroleum Corporation Limited(NNPC LTD) is one of the major oil and gas companies in Nigeria.

NNPC Limited is a dynamic global energy company with businesses and operations across the entire spectrum of the energy value chain.

NNPC Limited was founded in 1971 as Nigerian National Oil Corporation(NNOC), 15 years after the initial discovery of oil in commercial quantity at Oloibiri, Bayelsa state and in the same year of its founding it joined the Organization of Petroleum Exporting Countries (OPEC).

2.2 ORGANIZATIONAL CHART

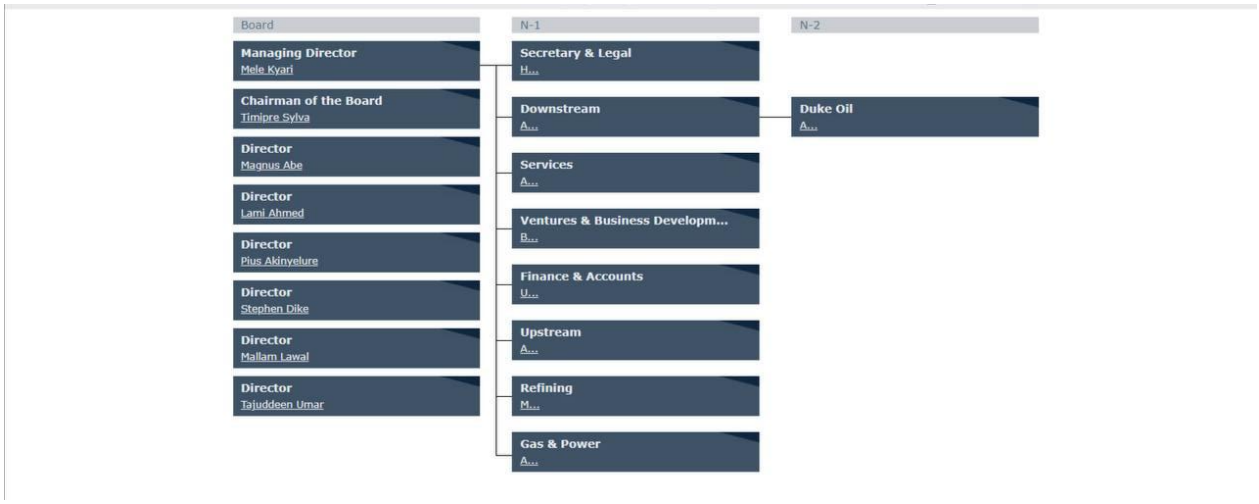


Fig 2.2.1 NNPC's Organizational Chart

2.3 CYBERSECURITY & VAPT

Cybersecurity is the protection of devices and systems such as hardware, software and data interconnected by the internet from cyberthreats and though information security it is considered an area in security it is not the same as cybersecurity as it focuses on the protection of information assets software or hardware.

Vulnerability assessment and penetration testing(VAPT) is the process of looking for vulnerabilities i.e flaws in a computer system and exploiting them to determine the security integrity of that system. It is normally referred to as Penetration Testing.

During the period the period my attachment at NNPC I underwent VAPT training in the Information and Technology department(ITD) under the supervision of Mr. Dayo Ogidi Q.A-CHQ and covered a wide range of topics and concepts in the field of cybersecurity. Below is a listing of the activities carried out:

CISSP Training(Informal)

I. During the period of my attachment I was privileged to study, review and practice the concepts in the **Certified Information Systems Security Professional(CISSP).** I learnt about regulatory frameworks and bodies that play crucial roles in the world of cyber and information security such as the **Health Insurance Portability and Accountability Act(HIPAA)** which is responsible for the protection of sensitive health information**, Payment Card Industry Data Security Standard(PCI-DSS)** which is responsible for the protection of credit and debit card details, **The Gramm-Leach-Bliley Act** which is responsible for ensuring transparency in business transactions and intents, **ISO 27001 & ISO 27002** which are common cybersecurity frameworks.

II. Best practices in an organization in relation to company infrastructure and resources and this entails the implementation of Identity and Access Management measures on accessible resources to define who can assess what to avoid unauthorized access to information or resources, implementation of physical security controls to enforce protection on core infrastructure like server rooms and endpoints such as work computers, education of employees to create awareness on common cyberthreats as human beings are often the weak link of any security measure or strategy.

III. I was also present in security meetings where discussions about the company's security posture were held, implementing what I learned as analysis and contributions.

As a result of my industry based supervisor making the CISSP mandatory it has strengthened my knowledge at the foundational level on securing an infrastructure.

Penetration Testing

During my attachment I also acquired practical cybersecurity knowledge and training via an online cybersecurity platform called **Hack The Box**, which equipped me with skills and techniques in the penetration testing field. The platform not only set my foundation in hacking but also helped me level up exponentially. I was required to learn and train on the platform daily and report on my progress to my industry based supervisor.

I. Usage of basic tools used in penetration testing such as SSH, Netcat, Tmux, Nano/vim to perform basic operations and stay organized.

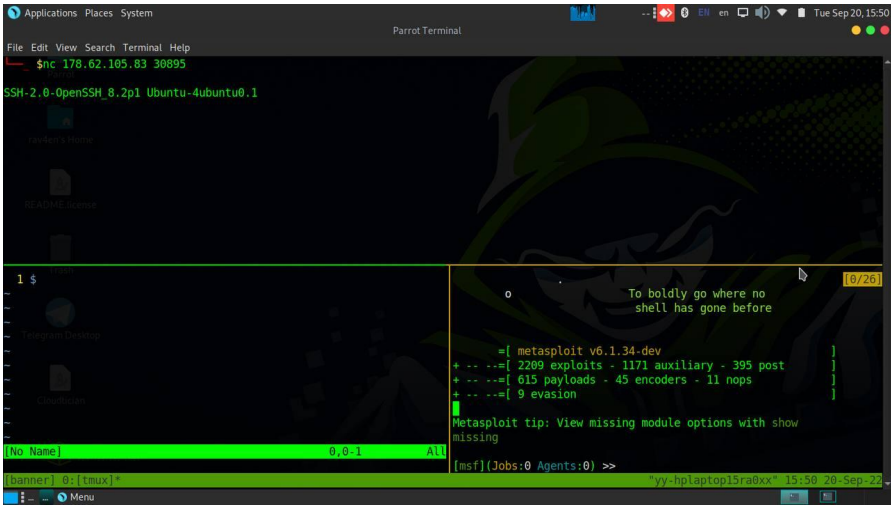


Fig.. 2.3.1 -Terminal with vim, netcat and tmux splitting them into panes

II. Performing service scanning on live hosts with **Nmap** to find out services running on the host including additional information of the discovered services such as port numbers,state of ports and version of the services, and also using nmap scripts to further enumerate specific services.

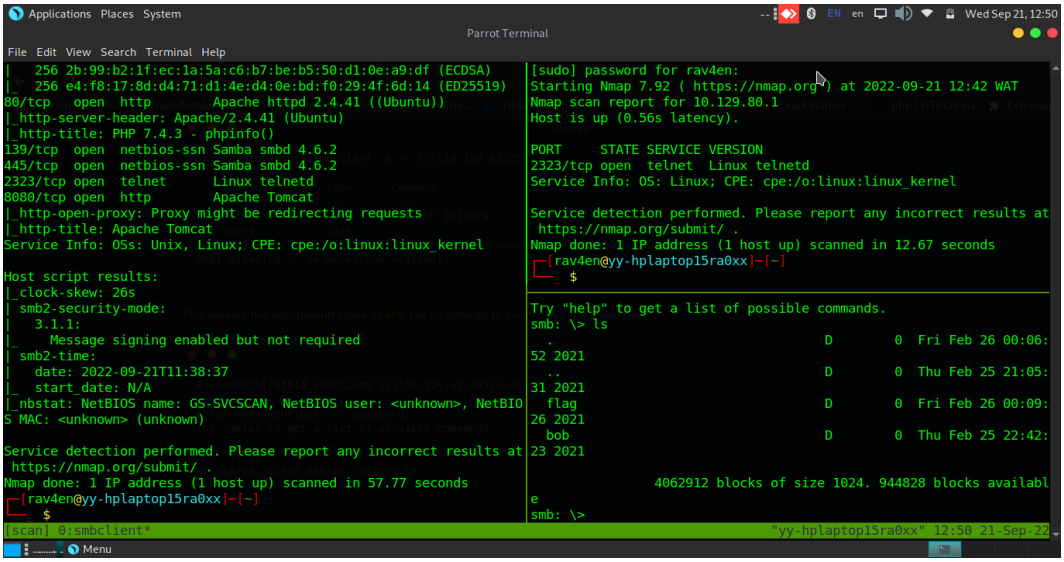


Fig. 2.3.2 -service scanning and enumeration with nmap.

III. Performing web enumeration and implementing techniques like directory enumeration/scanning with gobuster to find hidden directories like **robots.txt** which is a file that defines the pages that shouldn't show up on search i.e blocked from indexing by web crawlers such as Googlebot, Domain Name Service(DNS) enumeration, banner grabbing and information extraction from web servers such as versions, frameworks and SSL/TLS certificates. Another noteworthy technique implemented is source code enumeration.

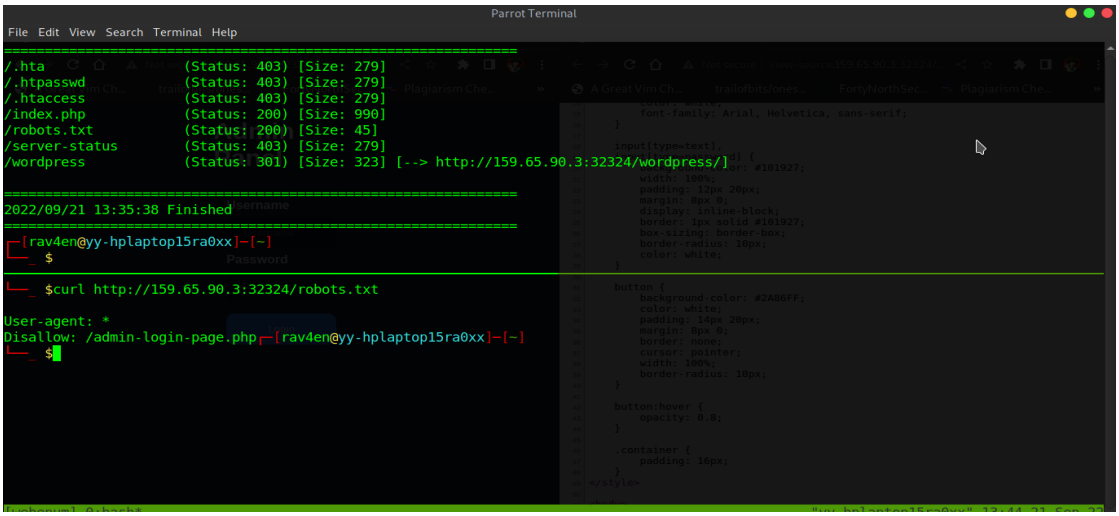


Fig. 2.3.3 -Web enumeration on a web server with gobuster and cURL.

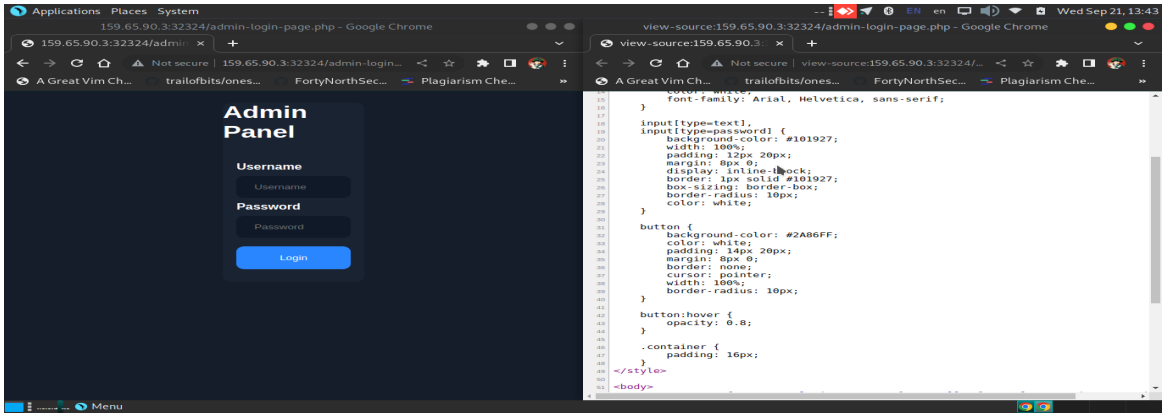


Fig. 2.3.4 -Admin login page(left) discovered in robots.txt file and page source(right) revealing mishandled credentials by the developer.

IV. Exploiting applications and services through public exploit databases such as **Rapid7**, **Exploit DB**, **Vulnerability Lab** manually and with the help of an automated tool called **Metasploit** which contains many built-in exploits for many public vulnerabilities and provides an easy way to use these exploits against targets that are vulnerable to them but the tool is not limited to exploits as it can perform a range of other actions such as reconnaissance, post-exploitation and pivoting.

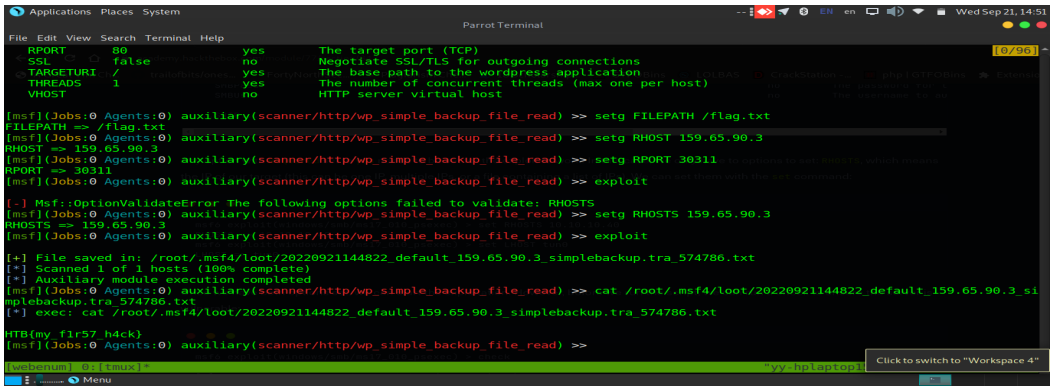


Fig. 2.3.5 -Exploiting a wordpress web application with the metasploit framework

V. Usage of shells and shell scripts to gain remote access to a server, i implemented the reverse shell by uploading a script with the payload on a website that had the file upload vulnerability and got shell access to the server.

VI. Performed privilege escalation after gaining user-level access to a server from a normal user to a root/administrator user granting me access to everything on the server. Once inside the server i ran enumeration scripts, kernel checks, possibly vulnerable softwares and processes, and enumerating services that run as root such as **SUDO, SUID binaries**, **SSH** keys and **Windows Token Privileges.**

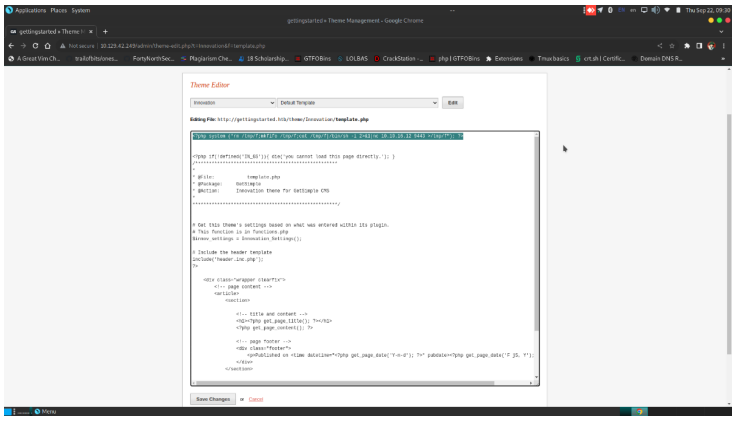


Fig. 2.3.6 -Gaining access to an admin panel and adding a reverse shell(highlighted) payload to a php file.

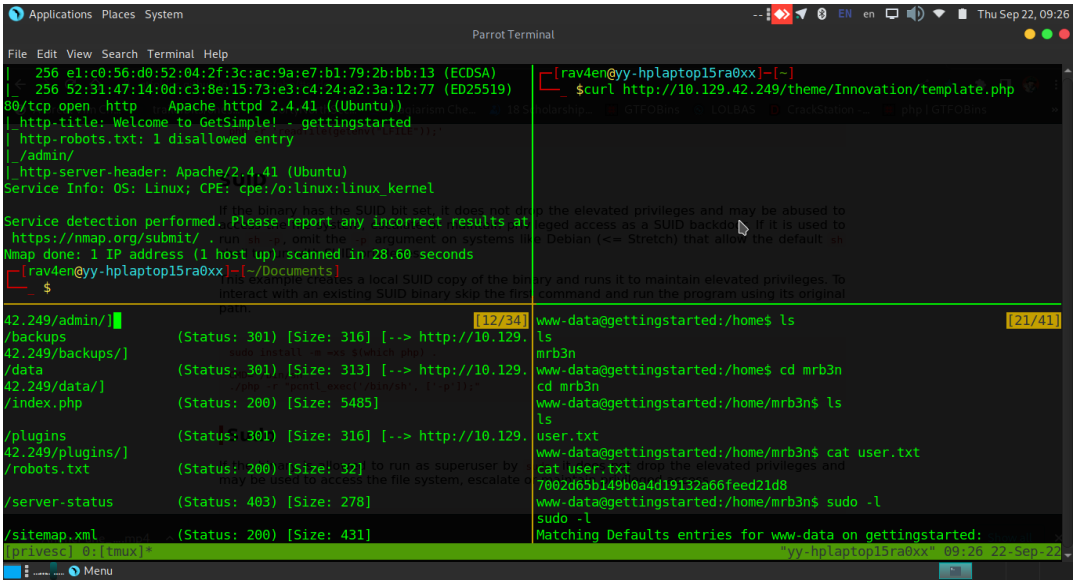


Fig. 2.3.7 -service scan(upper left), directory enumeration(lower left), reverse shell payload execution(upper right), listener and shell access(lower right).

VII. Lastly but not the least i learnt and implemented proper documentation techniques to stay organized and keep highlights and findings for reference going forward in an exercise.

CHAPTER THREE

3.1 GENERAL OVERVIEW OF ITB

ITB Nigeria Limited was established in 1995 by the CHAGOURY BROTHERS to address the growing demand for innovation and improved engineering expertise in Nigeria. With over two decades of experience in the construction industry, the teams of builders and civil engineering

contractors have established ITB as the leading provider of top-quality construction services across the country. Our successful track record of delivered projects and strong relationships with our clients have reinforced our position as leaders in the market.

3.2 ORGANIZATIONAL STRUCTURE

The organization is made up of different departments from the CEO to the CHAIRMAN, MANAGING DIRECTOR(MD), and to other departments. The departments are;

I. Human Resource (HR).
II. Architecture.
III. Quantity Survey (QS).
IV. Quality Assurance and Quality Control (QAQC).
V. Information Technology (IT).
VI. Planning.
VII. Accounting.
VIII. Payroll
IX. Procurement.
X. Logistics.
XI. Import.
XII. Legal.
XIII. Engineering.
XIV. Joinery

During my SIWES period I was opportuned to work under the Information Technology Department. The job done in the Info Tech Department is;

I. Network Creation.
II. Network Distribution.
III. Network Management.
IV. Radios, and network dish fixing.
V. Configuration of cameras and other network devices.
VI. Hardware Maintenance.
VII. Termination of Cables.
VIII. Troubleshooting and Work station setup.
IX. Installation and activation of Applications.

These jobs are carried out in their offices and their construction sites, hardware maintenance is mostly done in their offices while more of the networking aspect is carried out on the construction sites.

3.3 TROUBLESHOOTING SKILLS

Troubleshooting requires an organized and logical approach to problems with computers and other components. Sometimes issues arise during preventive maintenance. At other times, a worker may contact you with a problem. A logical approach to troubleshooting allows you to eliminate variables and identify causes of problems in a systematic order. Asking the right questions, testing the right hardware, and examining the right data helps you understand the problem and form a proposed solution.

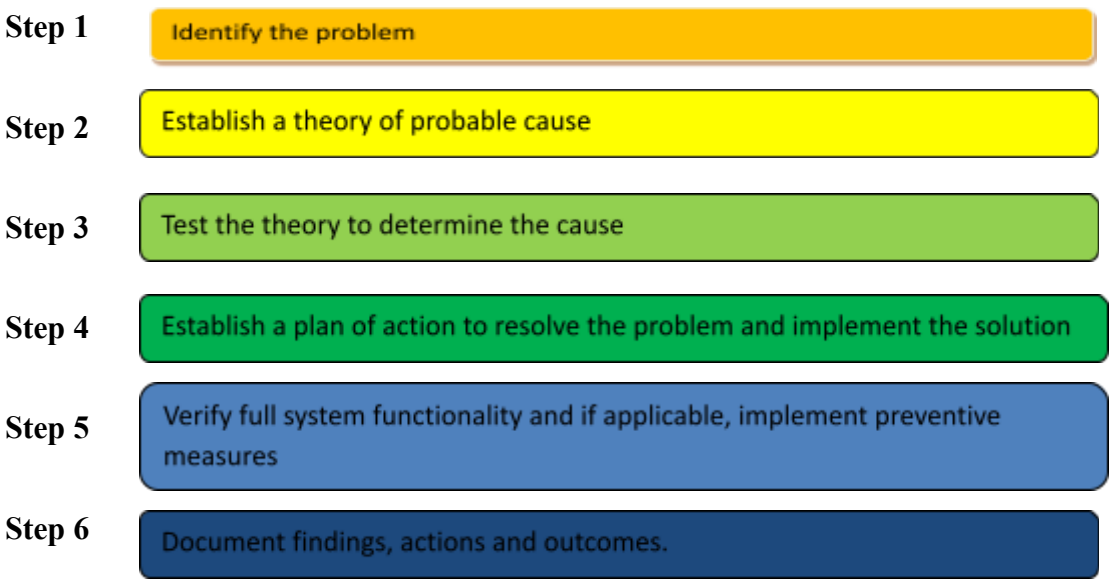
Troubleshooting is a skill that you refine over time. Each time you solve a problem, you increase your troubleshooting skills by gaining more experience. You learn how and when to combine steps, or skip steps, to reach a solution quickly. The troubleshooting process is a guideline that is modified to fit your needs.

This section presents an approach to problem-solving that you can apply to both hardware and software.

Before you begin troubleshooting problems, always follow the necessary precautions to protect data on a computer. Some repairs, such as replacing a hard drive or reinstalling an operating system, might put the data on the computer at risk. Make sure you do everything possible to prevent data loss while attempting repairs. If your work results in data loss for the worker, you or your department could be held liable.

Data Backup

A data backup is a copy of the data on a computer hard drive that is saved to another storage device or to cloud storage. Cloud storage is online storage that is accessed via the internet. In an organization, backups may be performed on a daily, weekly, or monthly basis. If you are unsure that a backup has been done, do not attempt any troubleshooting activities until you check to ensure that it has been backed up.



3.4 NETWORKING SKILLS

Later on, I was assigned to the Networking Side of the IT department, where I learnt different networking devices like the hubs, switches, routers and network printers. I was also able to identify various components used to develop network connections.

The things i learnt were;

I. How to terminate network (twisted pair) cables and how to connect computers to the local area network.

II. How to troubleshoot various networking problems, like when a user has connectivity problem, inability to log on to his or her user account etc.

III. Configuration of wireless connection on laptops and desktops.

IV. Configuration of switches, hubs and routers.

V. How to lay network cables.

VI. How to install a network printer and add it to a system.

Fig. 3.4.1 -Network Switch

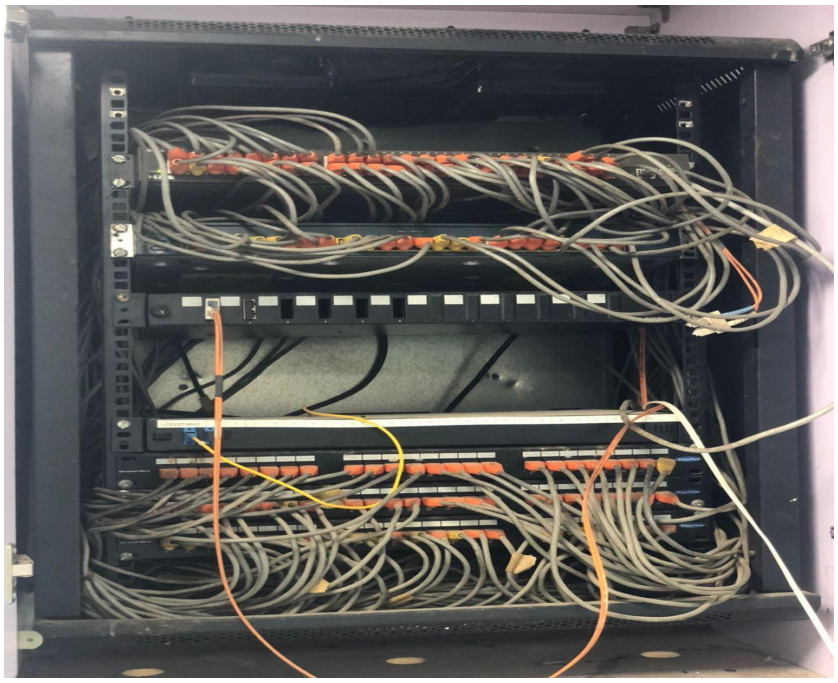


Fig. 3.4.2 - A Hub

A switch, such as the one shown in Figure 3.0, performs all of the same basic tasks as a hub, but the switch uses a set of internal logic circuits to establish a dedicated, logical path between the two PCs. A hub is a device that acts as a central connection point for computers on a network. Every computer plugs into the hub. This provides for more efficient data transfer without collision which occurs in the hub. They both have ports for RJ-45 connectors which computers use to connect to the network.

Fig. 3.4.3 -Network Adapter

The Network Adapter is the source through which the computer connects to the network as well as all other computers on the network.

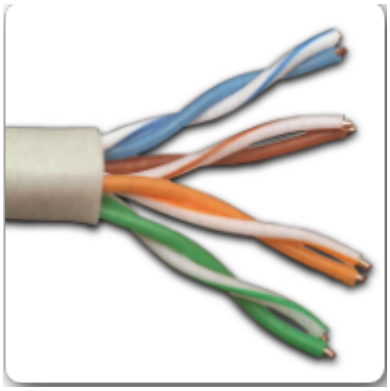


Fig. 3.4.4 - Ethernet Cable

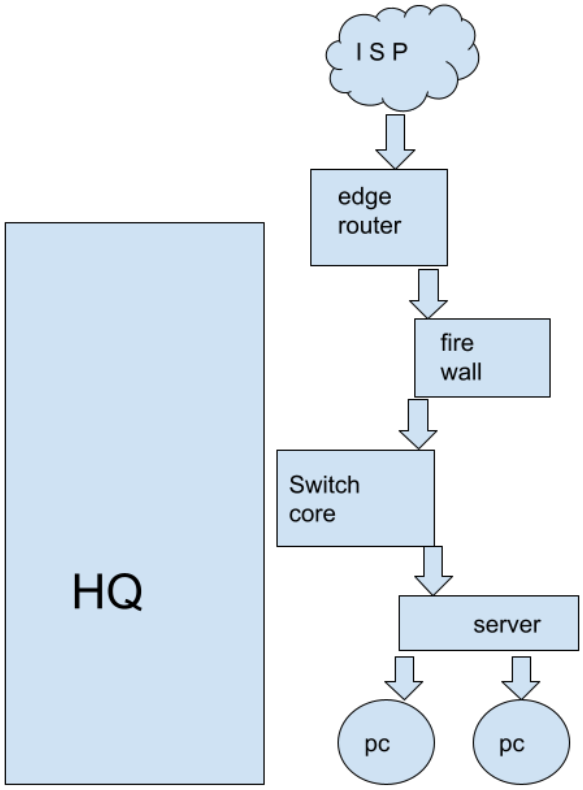
The Ethernet cable are network cables containing eight wires with different colours. These wires are arranged and "terminated" according to the type of connection needed. A network (Ethernet) cable with an RJ-45 connector terminated at the end. We have the straight ended terminated cable, for connecting devices that are dissimilar (e.g computer to hub/switch, switch to hub etc) We also have the cross ended terminated cable, for connecting devices that are the same (e,g computer to computer, switch to switch, hub to hub etc) The colors of the wires are orange, green, blue and brown. Four of these wires have these colors in full while the remaining four have the colors but with stripes of white along it. For straight ended cables, the color code is: White/Orange (i.e. orange color striped with white) followed by full Orange, white/green, then full blue, white/blue, full green, white/brown, full brown. For cross-ended cables, we have: White/green then full green, white/orange then full blue, white/blue then fullorange, white/brown then full brown. All these wires are arranged in line and inserted into the RJ-45 connector holding the copper strips towards your face which is then held in place then crimped by a crimping tool.

CRIMPING is the act of **affixing a connector to the end of a wire**. For example, a crimping tool is used to create phone cables and network cables to combine RJ-11 and RJ-45 connectors to both ends of the phone or Cat 6 cable.

Fig. 3.4.5 -Crimping Tool

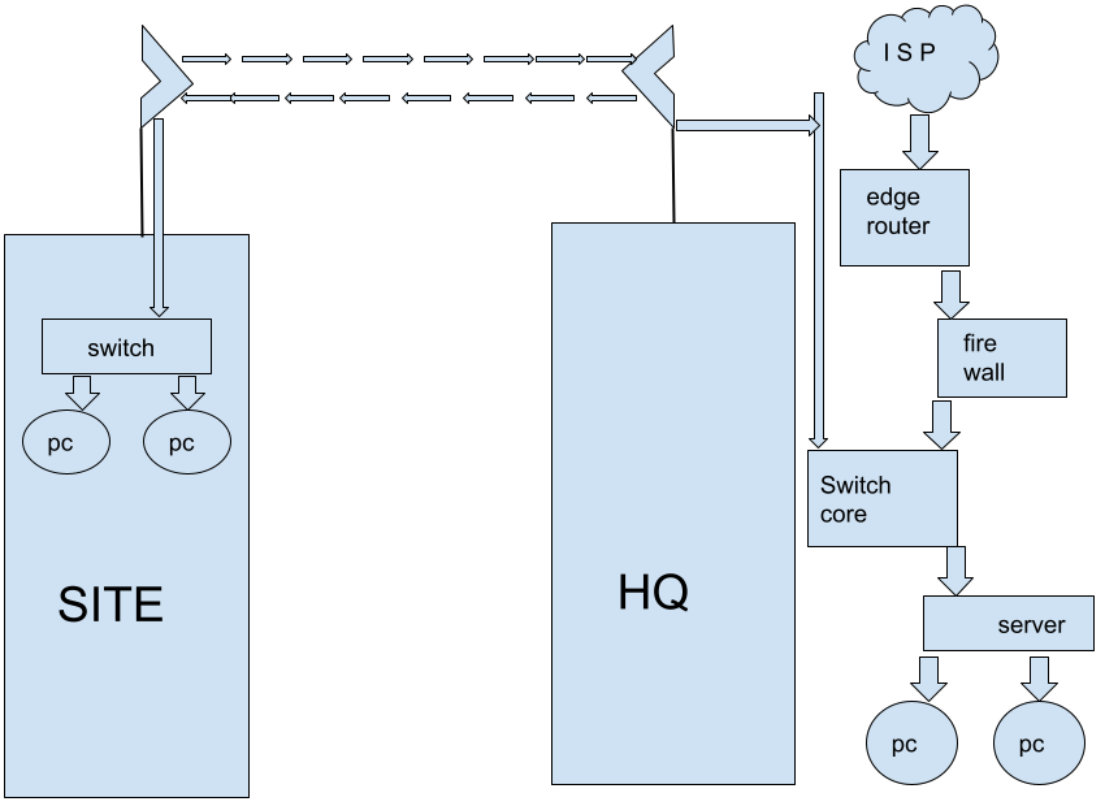
It is used to crimp connectors to cables. The 8p slot is used to crimp RJ-45 while the 4p slot is used to crimp the RJ-11.

PROCESS OF CREATING A NETWORK (THE NETWORK SETUP IN ITB)



The edge router is connected to the internet service provider (isp), linked to the edge router is the firewall which is connected to the switch core and the switch core is linked to the server,from the server room various computers or pc are connected and linked under one network or subnetted into different networks.

SHARING THE NETWORK TO CONSTRUCTION SITES AND OFFICES



To connect a site to the headquarters remotely a PUISP AIRMAX POWERBEAM AC, 5 GHZ BRIDGE is mounted on the hq building facing the site,then on the site facing the hq a M5 400 POWERBEAM is mounted which is connected to the switch then from there various PCs are connected together to the network.

3.4 HARDWARE SKILLS

I acquired hands-on experience in hardware skills mostly focused around hardware maintenance from dust blowing of the system unit to replacement of components like RAM, Processor, Cooling fans, Hard drives.

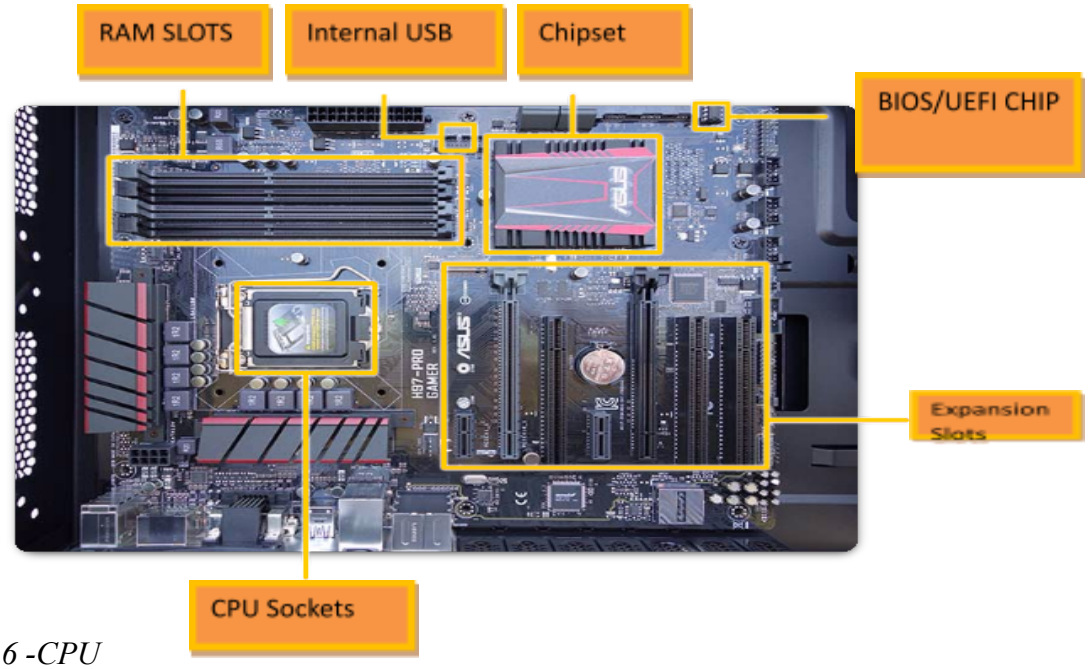

RAM SLOTS
Internal USB
Chipset
BIOS/UEFI CHIP
Expansion Slots
CPU Sockets

Fig. 3.4.6 -CPU

CHAPTER FOUR

4.1 CHALLENGES DURING ATTACHMENT

I. No internet access on premises.

II. Traffic during early hours of the day and after work.

III. Inadequate supervision by industry staff for IT students.

4.2 CONCLUSION

After undergoing all these activities for the past **six** months I have acquired basic practical and theoretical knowledge that I wouldn't have gotten from a lecture room, it has also given me the experience I need to kickstart a career in the field and departments in which I served.

After my internship with the Nigerian National Petroleum Corporation Limited (NNPC) LTD and ITB Nigeria Limited:

I. I can perform basic penetration tests on end-points and infrastructure.

II. I can effectively write detailed reports on any pentesting exercise I perform.

III. I can perform vulnerability scanning and assessments.

IV. I can draft and implement security best practices for both individuals and system admins.

V. I can perform web penetration tests on web technologies such as wordpress and web frameworks such as Django, Laravel, etc.

VI. I can handle service and IT support roles and tasks such as repairs, installations, maintenance and set-ups.

VII. I can assist in the administration of networks , both LAN and WAN.

VIII. I can effectively crimp and run cables for an infrastructure.

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ITB - About us - https://www.itbng.com/about-us