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An Undergraduate Internship/Project on Enterprise Wireless Network Solutions

Rajit, Shahnewaz Muhammad

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An Undergraduate Internship/Project on Enterprise Wireless Network Solutions

By

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Autumn, 2022

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January 24, 2023

Dissertation submitted in partial fulfillment for the degree of Bachelor of Science in Computer Science & Engineering

Department of Computer Science & Engineering

Independent University, Bangladesh

Attestation

This is to confirm that I, Shahnewaz Muhammad Rajit (1630736), finished the report titled "Enterprise Wireless Network Solutions," which I submitted as a partial fulfillment of the requirement for the Degree of Computer Science and Engineering from Independent University, Bangladesh (IUB). It was finished with the help of Company Supervisor and University Supervisor. Additionally, I attest that all of the work I've done since finishing my internship is entirely unique. All information sources used in this project and report have been properly acknowledged.

Rajit

Signature

31-01-2023

Date

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Acknowledgement

I want to start by thanking Almighty Allah (SWT) for his mercy in allowing me to complete my internship report on time. I want to express my gratitude to the Faculty of Computer Science and Engineering department for maintaining internship credit in the graduating program's curriculum and providing me with a chance to sample industry-oriented duties and a line of work that interests me. I want to express my sincere gratitude to Sabrina Alam, a lecturer in the department of computer science and engineering at Independent University in Bangladesh, who served as my supervisor and inspired and guided me during the course of my internship and the writing of my report. From the bottom of my heart, I want to express my gratitude to my technical supervisor, Project Coordinator, and Global Informatics Limited for their kind encouragement, direction, constructive criticism, supervision, instructions, and advice. They also inspired me to complete my internship at Global Informatics Limited successfully. I'm happy and glad that I was always under the project coordinator's direct supervision and received guidance from the networking team. My experience in the internship life is enhanced by the daily reporting, as well as the mental and professional support, provided here. Internship Report In addition, I'd like to thank the entire team at Global Informatics Limited for their guidance and assistance over the course of my internship. Additionally, I must point out this organization's fantastic working atmosphere and devotion to the group, both of which have given me the ability to handle a variety of situations. Last but not least, I want to express my gratitude to my parents and other family members for their unending support.

Letter of Transmittal

24th January,2023

Sabrina Alam

Lecturer

Department of Computer Science and Engineering School of Engineering and Computer Science

Independent University, Bangladesh

Subject**:** Submission of Internship Report for the completion of Graduation.

Dear Ma’am,

In accordance with the requirements of the Bachelor of Science in Computer Science and Engineering program, I now submit my internship report. Working under your active guidance is an outstanding accomplishment. The "Enterprise Wireless Network Solutions" are the foundation of this paper. I was given the chance to work with Global Informatics Limited for three months under the direction of the co-project supervisor. I have gained both intellectual and practical experience through my internship. I have had the chance to build a network within the corporate environment thanks to the internship. With the knowledge I've received through my internship, I've attempted to be as informative as I can be in this report. I have adhered to the instructions and provided adequate details for the required fields in order to generate a well-organized internship report. But I genuinely think that this report will help my internship program achieve its goals.

Please accept my sincere thanks if you can read this report and offer your insightful opinion. If you found this report useful and illuminating in acquiring a thorough understanding of the issue, it would make me very happy.

Sincerely Yours,

Shahnewaz Muhammad Rajit

ID- 1630736

Department of Computer Science and Engineering,

Independent University, Bangladesh

Evaluation Committee

.....

Signature

Sabrina Alam

Name

Sabrina Alam

Supervisor

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Signature

Rubayed Mehedi

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Name

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Internal Examiner

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Signature

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Name

Md Abu Sayed

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External Examiner

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Signature

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Name

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Convener

5

Abstract

This report details the knowledge I gained from the internship program I participated in at Global Informatics Limited. In order to activate the world around us, Global Informatics Limited, a networking and IT solutions provider with offices in Bangladesh, offers solutions. Global Informatics Limited provides goods and services to improve not just enterprises but also your day-to-day activities. Main services provided by Global informatics limited are: - Structured Lan, Enterprise Wireless Network Solutions, Enterprise Switching and Routing, Security and IP Surveillance, Data Storage and Server Solutions, IP PBX Solutions, Data Center Solutions, Firewall/Internet Security, Access Control & Attendance System etc. In order to fulfill my internship program as a networking person employed by the company, Global Informatics Limited chose me as an intern to build them a networking-based internet system. The project's goal was to provide an internet that could be widely distributed. The project needs GWN cloud because it has its own security channel.

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Chapter 1

Introduction

1.1 Overview/Background of the Work

Because I'm doing it for an internship, the project of developing enterprise wireless network solutions was something new for me to begin. AP configuration created a fresh problem for me to solve. I had to apply what I had learned from them and overcome the peculiar hurdle of doing it appropriately. This misperception is typical. We had to learn how to set up the GWN cloud, AP, and Mikrotik router. To fully execute them, we had to deal with new obstacles.

1.2 Objectives

The things we want to accomplish at the project's end are its objectives. The goal of a project must be clear, measurable, conform to the budget and time restrictions, and most importantly, meet the needs of the client. The following is a description of this application's primary goals:

- No restrictions on the number of sites or APs, complete scalability
- Accessible using the GWN or web interface from anywhere. iOS and Android mobile apps for the cloud
- complete network surveillance and reporting
- due to being hosted by Amazon Web Services, high reliability (AWS)

1.3 Scopes

Adaptability to cloud disruptions:

The capacity of your cloud architecture to endure interruptions, both unintentional and intentional, and effectively recover from them is known as cloud resilience. Data and technology are now more pervasive in how we communicate.

supports setting up access policies (blacklist, whitelist, time policy):

Access from wireless terminals is controlled using the STA blacklist and whitelist. Trusted STAs can be added to a whitelist profile to grant them access to the WLAN, while questionable or troublesome STAs can be added to a blacklist profile to deny them access.

Chapter 2

Literature Review

Comprehensive analysis of computer networks and the underlying data communication technologies. Network categories and topologies, the OSI model, the TCP/IP protocol suite, TCP/IP applications such as FTP, SMTP, HTTP, and the World Wide Web, transport layer protocols, link layer protocols, internetworking devices such as repeaters, bridges and routers, routing algorithms, IP addressing, sub netting, domain name systems, network programming, LAN types and technology, MAC protocols, high speed LANs and Gigabit Ethernet, Wireless LANs, MAN, Mesh Network, DHCP Server, NAT, SNMP.

Determine the issues with networked communication. Describe the benefits and drawbacks of the current solutions to these issues in the context of various networking rules.

2.1 Relationship with Undergraduate Studies

With the knowledge and skills, I learned and studied in various classes here at Independent University, Bangladesh (IUB), I was able to participate in and work on this project at Global Informatics Limited. I had to pick up a few more skills throughout these seminars in order to match my expertise to the needs of the business. The following are a few of the courses that I found useful:

CSE316: Data Communication and Computer Networks- This course's lesson was somewhat applicable to my line of work. I learned about the OSI reference model and the seven levels of network communication in this course. Other topics included routing algorithms, IP addressing, subnetting, network programming, LAN kinds and technology, the TCP/IP protocol suite, TCP/IP applications, FTP, transport layer protocols, link-layer protocols, internetworking devices, and others. The knowledge gained in this course was crucial in building the campus network, an organizational network.

2.2 Related works

Every university need wireless network related internet service. Cause this type of system cover up the huge amount of area. Larger organizations and events have historically used wireless APs because it takes a lot of APs to handle thousands of people on the internet. The Access Point will assign connected devices an IP address in a private range using DHCP. Yes, IP addresses and MAC addresses are both present in and used by access points. In accordance with the network and configuration, an access point may have a single IPv4 address or both IPv4 and IPv6 addresses. Additionally, they are often configured with a static IP address that is not in the DHCP address space. A client must change access points when it moves from one access point's range to another because its signal level dropped. During this process, the client's MAC address stays the same.

Chapter 3

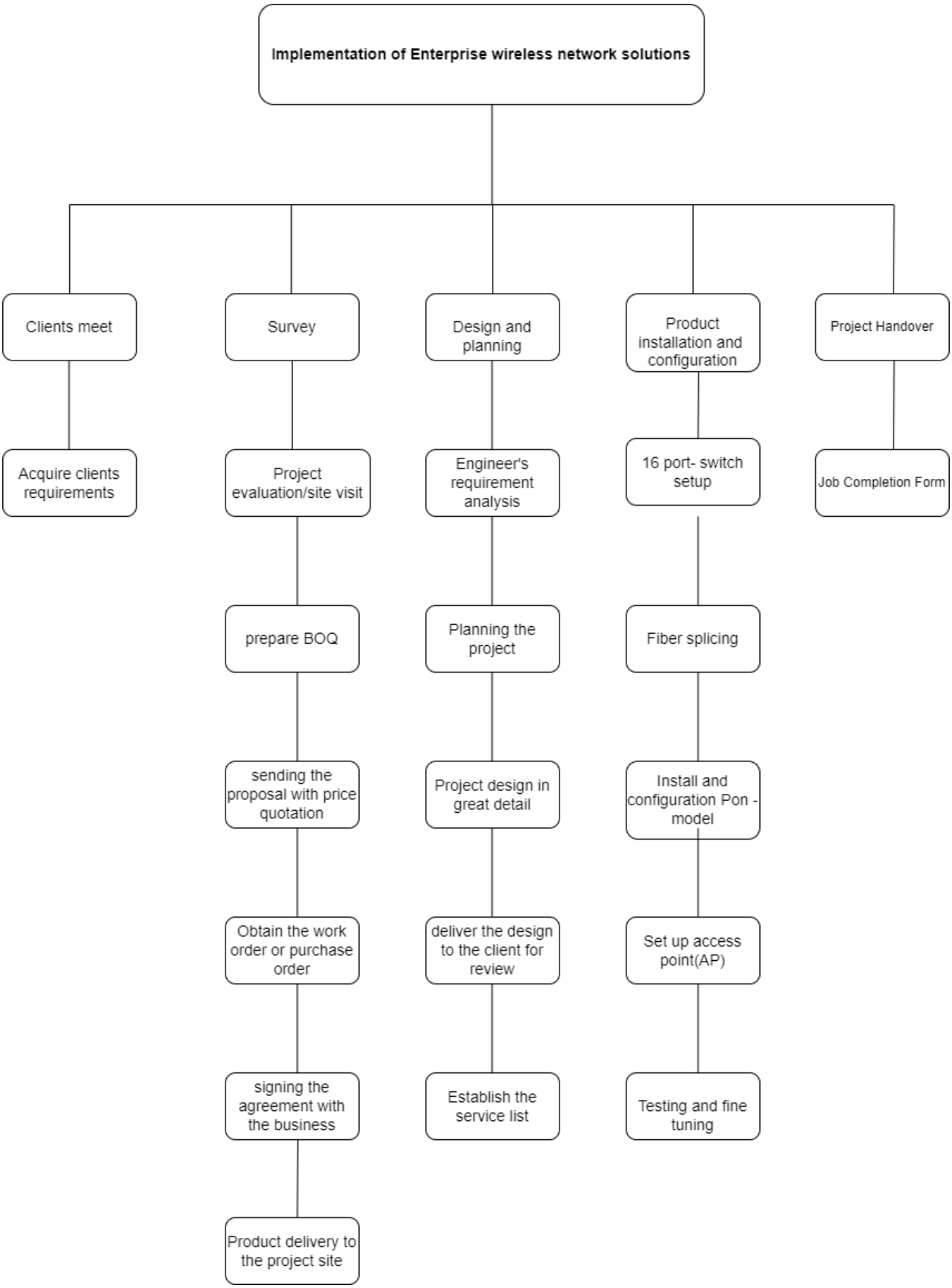
Project Management & Financing

3.1 Work Breakdown Structure

Projects, programs, and even initiatives may use a work breakdown structure to understand the work that must be done in order to successfully produce a deliverable (WBS). Using a WBS framework, you can see how a project is broken down into smaller parts. To ensure that our work is coordinated, we configure a WBS for each of our projects. Without leaving any essential deliverables, WBS offers a visual depiction of all the scopes, risks, points of communication, pricing, and assurances. This is the perfect tool for the team to brainstorm and work together. In our WBS, we used the top-down approach.

Work Breakdown Structure for Enterprise wireless network solutions –

Figure 3.1: Work Breakdown Structure


Implementation of Enterprise wireless network solutions
Clients meet
Survey
Design and planning
Product installation and configuration
Project Handover
Acquire clients requirements
Project evaluation/site visit
Engineer's requirement analysis
16 port- switch setup
Job Completion Form
prepare BOQ
Planning the project
Fiber splicing
sending the proposal with price quotation
Project design in great detail
Install and configuration Pon - model
Obtain the work order or purchase order
deliver the design to the client for review
Set up access point(AP)
signing the agreement with the business
Establish the service list
Testing and fine tuning
Product delivery to the project site

3.2 Process/Activity wise Time Distribution

There are six processes in the project, according to my WBS. A specific amount of time is allotted to finish each process. The project will be completed quickly if it is broken up into manageable pieces and given a deadline. The project can take longer than necessary if there is no time frame specified. The time distribution of my project, broken down by process and activity, is shown below:

Table 3.2: Process/Activity wise Time Distribution

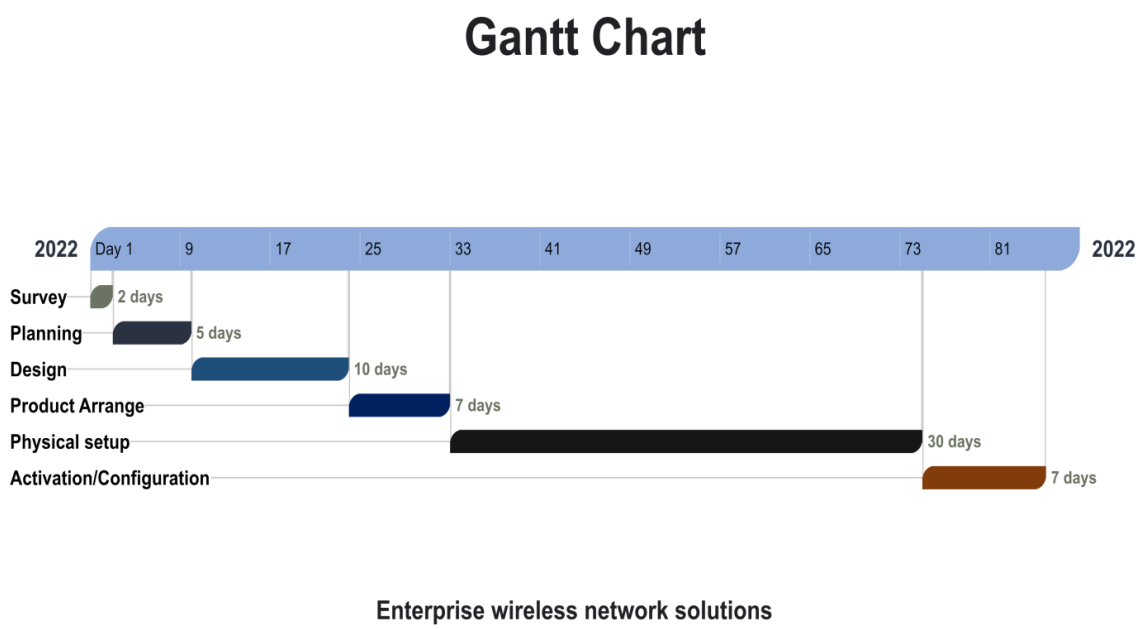
Process/ Activity wise time distribution

Activity	Time Duration	Work Percentage
Survey	2	5
Planning	5	5
Design	10	10
Product Arrange	7	10
Physical setup	30	60
Activation/Configuration	7	10
	61	100

3.3 Gantt Chart

A Gantt chart is a diagram that displays all of a project's subtasks and how they interact with one another over time. Every task that needs to be completed is listed along with its estimated duration, deadline, and linkages to other tasks in a Gantt chart.

Figure 3.3: Gantt Chart



3.4 Process/Activity wise Resource Allocation

Now let's talk about allocating resources to processes and activities. The resource allocation chart I created is shown below. Here is the combo of my tasks. I always try to finish as much of my work as I can and turn it in on time.

Survey – We are still in the survey's preliminary stage. Where ideas for the project was first conceived. We developed the idea for such a solution for AP and got things moving.

Planning – We began planning the appearance and feel of the applications at this stage. We made plans on how to achieve our goals after setting them. Additionally, it was intended to develop many configurations that will be very beneficial for our AP.

Design – This marked the start of the main work. Microsoft Visio was used to help us create the design. We first identified goals for constructing different system components. After achieving our daily objectives, we move on to setting the following ones. Things slowed down in the middle as we sought solutions to issues, we encountered while designing.

Products arrange – Through our retail and internet sources, we organize the merchandise. Collecting the full product must be crucial before our physical setup.

Physical setup – Using the needs of our clients, we set up the AP at every location. Core 12 cable is also connected to the AP. To divide the cable signal between two or more devices, we utilize splitters. The server and our AP are connected directly.

Activation/ Configuration – With the aid of the data server, we set up our AP and establish a connection to the cloud system.

Table: 3.5 Estimated Costing

3.5 Estimated Costing

Features	UoM	Quantity	amount	total
Mikrotik Router		1	50000	50000 tk
SFP Switch		1	51000	51000 tk
Access point (AP)	PCS	80	25000	2400000 tk
4 core cable Optical fiber	Meter	2000	15	30000 tk
SFP Module (LC-LC)	Pair	9	3000	27000 tk
Fiber Patch Chord	PCS	9	500	4,500 tk
ODF Patch panel	PCS	1	15000	15000 tk
TJ Box	PCS	8	1500	12000 tk
Rack	PCS	9	8000	72000 tk
Switch – 16 port	PCS	8	22000	176000 tk
UTP cable	Box	10	16000	160000 tk
				2,997,500 tk

Chapter 4

Methodology

In the Prepare phase, organizational (business) needs are established, a network strategy is created, a high-level conceptual architecture is proposed, and technologies that can best support the architecture are identified. By evaluating the business case for the suggested design, it is possible to build financial support for the network strategy.

During Plan stage, the network needs must be determined based on the network's objectives, the location where it will be deployed, the users of which network services, etc. In the Plan phase, it is also necessary to evaluate the locations where the network will be installed as well as any current networks. A gap analysis is then carried out to see if the current system infrastructure, locations, and operating environment can support the proposed system. The tasks, responsibilities, important deadlines, and resources needed to accomplish the network improvements are managed with the aid of a project plan. The scope, cost, and resource characteristics specified in the first business requirements should be reflected in the project plan. This stage results in a list of network specifications.

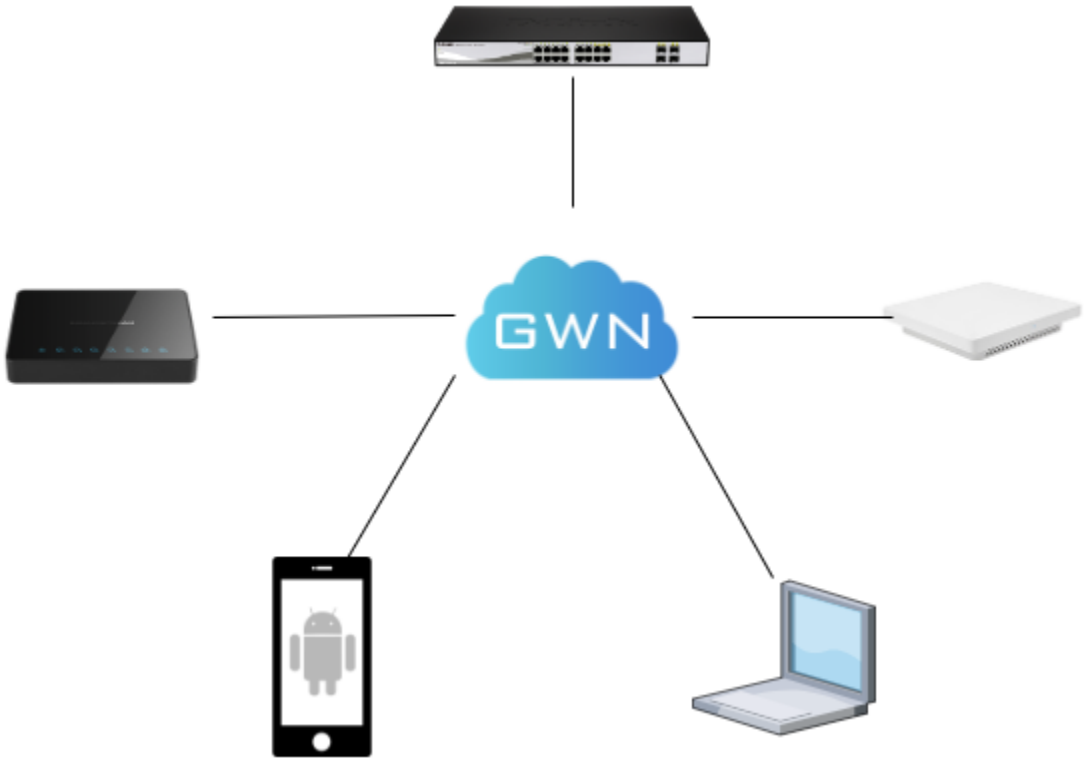
The efforts of the network design professionals are guided by the first requirements established in the Plan stage. When updating an existing network, these experts construct the network in accordance with the initial needs, taking into account any new information learned through network analysis and audit as well as discussions with managers and network users. It includes specifications to support availability, reliability, security, scalability, and performance. The network design specification that is produced is a thorough detailed design that complies with present business and technological needs. The implementation activities will be built upon this design specification.

Once the design has been accepted, implementation and verification can start. The objective of device integration is to integrate devices without destabilizing the current network or introducing weak points, so the network and any extra components are established in accordance with the design criteria.

The design's suitability is ultimately tested during operation. The Operate phase involves keeping the network healthy through routine tasks, which may include preserving high availability and cutting costs. Initial data for the Optimize phase of the network lifecycle is provided by the fault detection, rectification, and performance monitoring that takes place throughout everyday operations.

The Optimize phase's proactive network management approach aims to find and fix issues before they become serious issues and have an impact on the organization. When proactive management is unable to anticipate and mitigate failures, reactive fault detection and repair (troubleshooting) is required. If too many network issues or mistakes occur, performance falls short of expectations, or new applications are found to fulfill organizational and technological requirements.

Figure 4.1: Methodology



Chapter 5

Body of the Project

5.1 Work Description

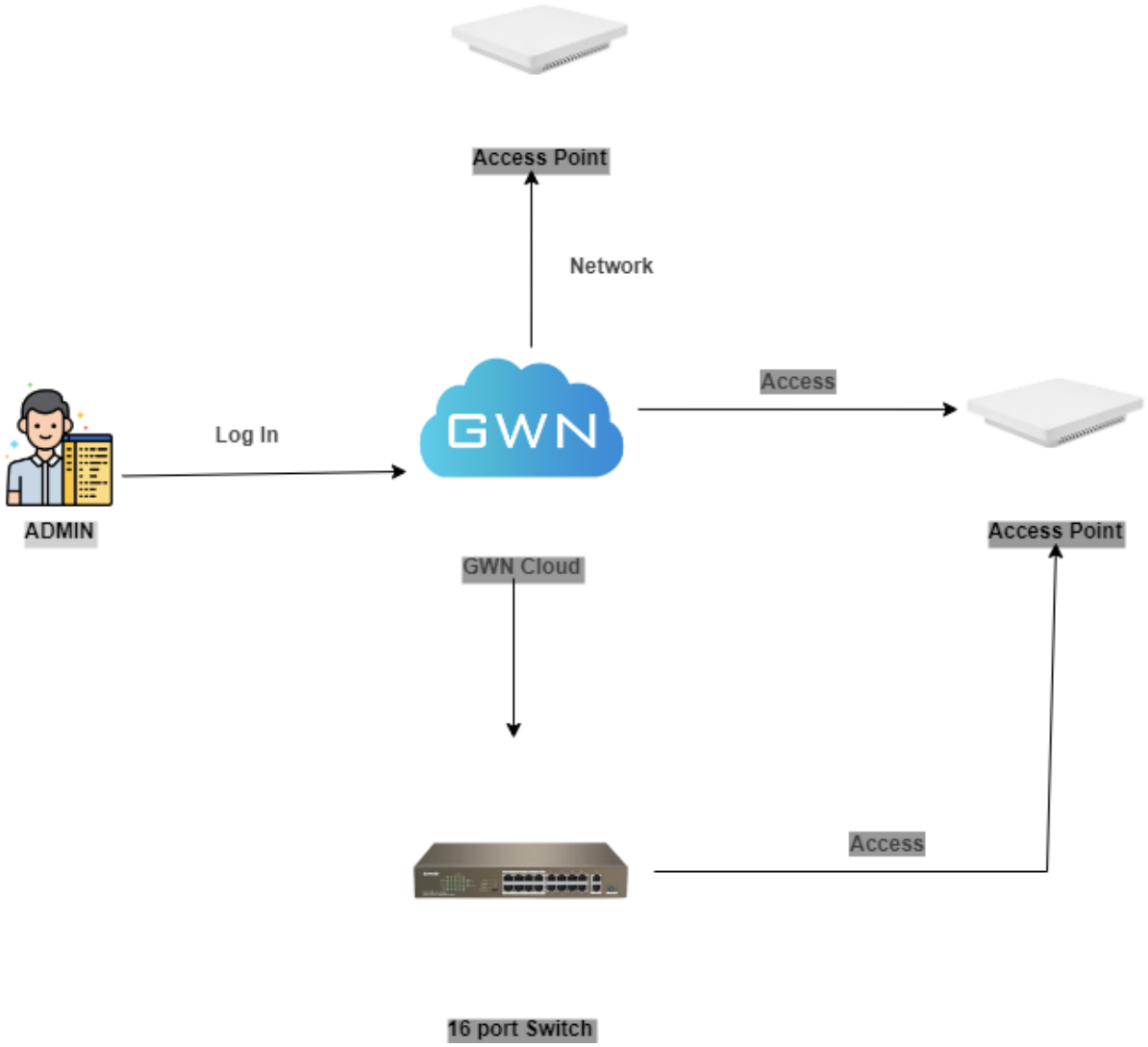
To develop a user-friendly enterprise wireless network solution to serve network via access point and data for an enterprise is the aim of the Project. Through the enterprise wireless network solution, we can setup the AP, the rack, the switch and configure the AP. The aims of this project are to Enterprise Level Wi-Fi connections between users that can serve larger loads by enterprise-level connection hardware without dropping signals or tapering off into dead zones.so that we can serve the internet without difficult. My project is to create enterprise wireless network solution to provide the smooth connectivity without wire. A company's whole wireless connection spread by the access point (AP).

5.2 Requirement Analysis

When building a system, functional requirements are useful since they inform us of the features, we should expect from it. The following functional requirements were attempted to be met by the project:

Rich Picture

Figure 5.2: Rich Picture



Functional and Non-Functional Requirements

Functional Requirement:

- For access point configuration, we needed a Mac address and password from AP.
- After that we give a fixed Ip address for Ap.
- For Wi-fi settings we go to Add SSID then give our ap security mode, WPA key mode, WPA encryption type, WPA pre shared key, SSID Band, Client IP assignment.
- For every client Ap have random voucher and also have time limit, speed limit, upload speed and download speed

Non- functional Requirement:

- Without addressing a Mac address, that AP is not working and every ap have their individual MAC address.
- After configure AP our selected client can access that and take data from it, it shows on our dashboard.
- The AP have good performance for a huge area, where internet user uses the internet easily.
- Admin can see how much bandwidth usage and count the user.

5.3 System Analysis

5.3.1 Six Element Analysis

Table:5.3.1- six element analysis

Process	**System roles**					
	Human	**Non-Computing Hardware**	**Computing hardware**	**Software/system**	**Database**	**Communication**
Requirement Analysis	1.Admin Describe the project and its specifications. 2.Interns Recognize the project's specifications and workflow	1.To note the requirement, a pen and paper were required.	1.Laptop Required for Documentation, Softcopy Maintained 2.Needs a printer to print a physical copy	1.Using MS/Word for documentation	None	1.Internet-connected Wi-Fi printers use the internet to get printing instructions from laptops and desktop computers.
Planning and designing	Plans were made by interns on project benefits and risks.	1.To note the requirement, a pen and paper were required.	1.Laptop Required for Documentation, Softcopy Maintained	1.Using MS/Word for documentation	None	1.Internet Information on the project must be gathered

configuration	Made documentation by interns	None	AP, UTP cable, !6-port switch, Optical fiber, Rack, Mikrotik Router	GWN Cloud	None	1.Internet Information on the project must be gathered
Implementation	Interns Execute the assigned work.	None	1.Laptop Needed to implement the project.	GWN Cloud	None	1.Internet Information on the project must be gathered
Testing	Made documentation by interns	None	1. Laptop Needed to Test the project.	GWN Cloud	None	1.Internet Information on the project must be gathered
Handover	1.Interns completed the project report and handed it in to the manager. 2.Admin Compile the project and report.	None	1.Needed a laptop to create the project report. 2.Printing on paper is required.	1.Using MS/Word for documentation	None	1.Internet Information on the project must be gathered

5.3.2 Feasibility Analysis

5.3.2: **Feasibility Analysis**: A feasibility study is a report that describes certain aspects of a project and how they might advance it. Any prospective project difficulties might be more easily identified by analyzing the feasibility criteria. To determine whether a project is feasible, a feasibility study is necessary. The following list includes the feasibility elements that we looked at for the Ap configuration for an enterprise wireless network solution:

Operational Feasibility: The project would only be considered successful in the operational feasibility sector if all of its requirements were met and it operated successfully. The project was a success thanks to the efficient use of the fast internet access, which was set up in a well-designed building. The project's total success was attributed to its immaculate design and construction, as well as the development of a straightforward wireless networking system for IT components.

Feasibility of Scheduling: If a project is to be successful, it must be completed on schedule. All tasks were completed according to schedule, and the project was completed on time.

Economic Feasibility: A study of the project's economic viability must be done in order to establish its financial viability. The majority of the expenditures associated with surveying, planning, implementation, and configuration fall on this industry. The analysis of the data determines whether the project will be financially viable. Budget and maintaining GIL profit were discussed.

Technical Feasibility: The technological resources that we have at our disposal in our business are the topic of this evaluation. Analyzing technology resources and experts' capacity to transform concepts into workable System solutions are crucial parts of this procedure. The emphasis on technological viability achieves this. This analysis is done to determine whether it will be effective and successful to manage these technical devices during the network construction phase. The Mikrotik router, optical fiber, switch, and access point were the most important networking components in our project, and the caliber of these components will determine the security of the wireless networking. The majority of the gear we used for this project was of a good caliber, especially the AP. Therefore, this project is technically feasible.

5.3.3 Problem Solution Analysis

- We ensure that the power system connection is correctly work and we have alternative option which is UPS for wireless networking.
- Connection between 16 port switch and access point is important for spread internet to the user.
- GWN cloud need a MAC address of Ap without this ap configuration stop.
- Selection of Bandwidth is important for the user and our cloud system to give an opportunity for 2.4G or 5G or both.
- Voucher selection also an important rule for the user where they know about their internet connection time schedule.

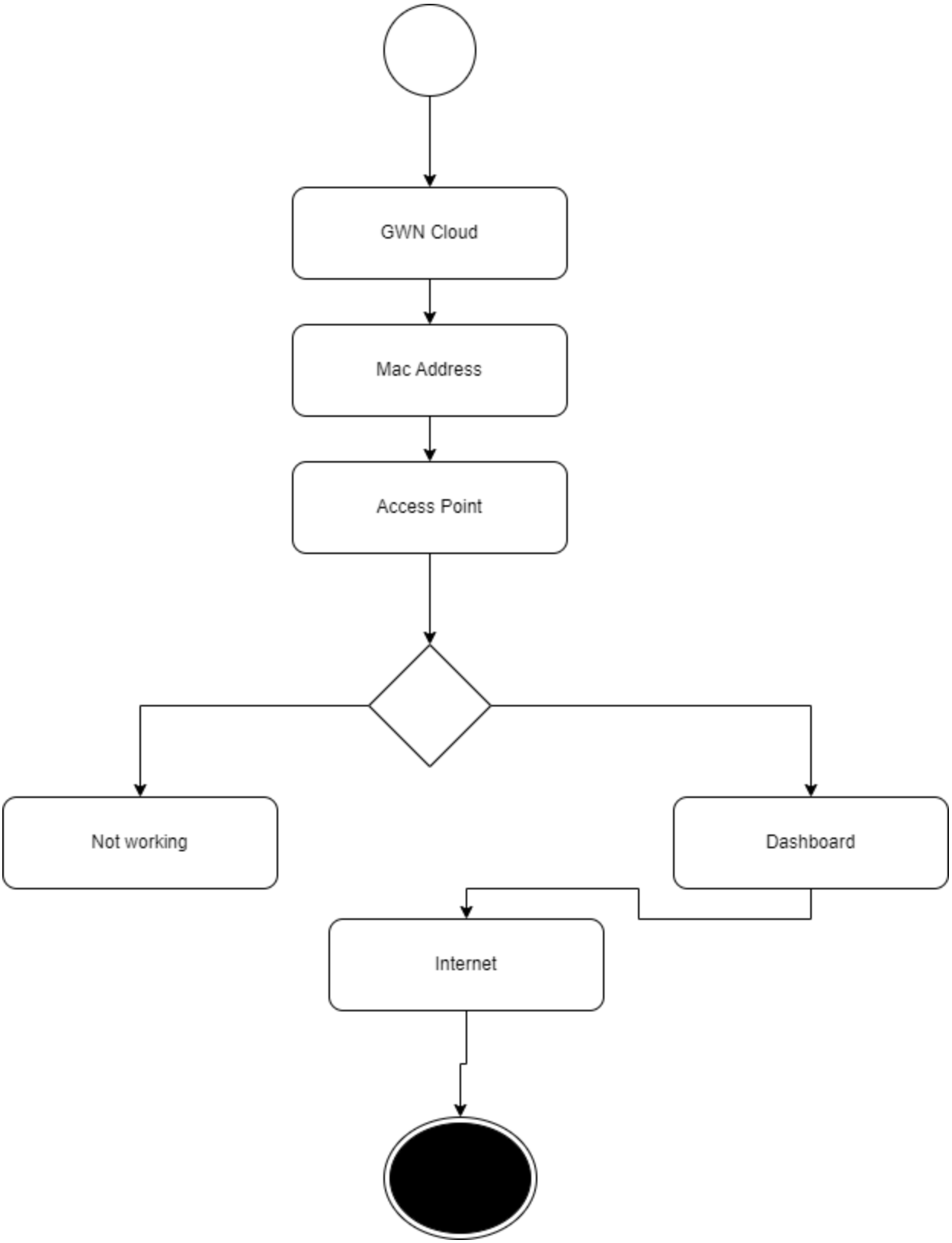
5.3.4 Effect and Constraints Analysis

To serve the internet easily, our strategy was to build an enterprise wireless network solution. The 16-port switch can serve components like the network and AP once it has been configured. And my task was to set up an access point and build an enterprise wireless network. In the enterprise wireless network, we are continuously trying to implement a system with a cloud system—the GWN Cloud—and an internet system that will help APs maintain connections to these components or users quickly and simply.

5.4 System Design

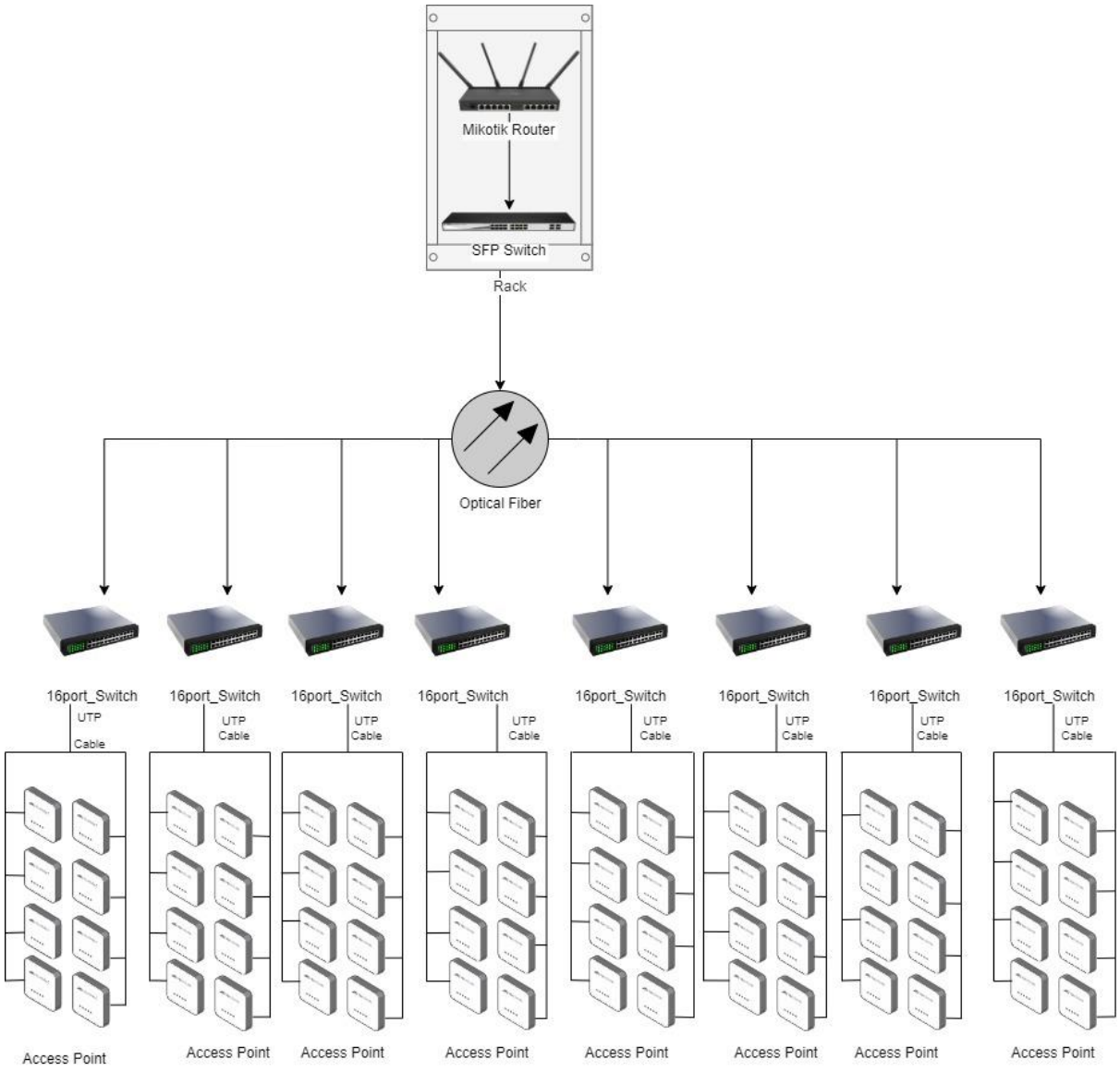
5.4.1 UML Diagrams

Figure 5.4.1: Activity Diagram


GWN Cloud
Mac Address
Access Point
Not working
Dashboard
Internet

5.4.2 Architecture

Figure 5.4.2: Architecture



5.5 Implementation

Figure 5.5.1: Configuration

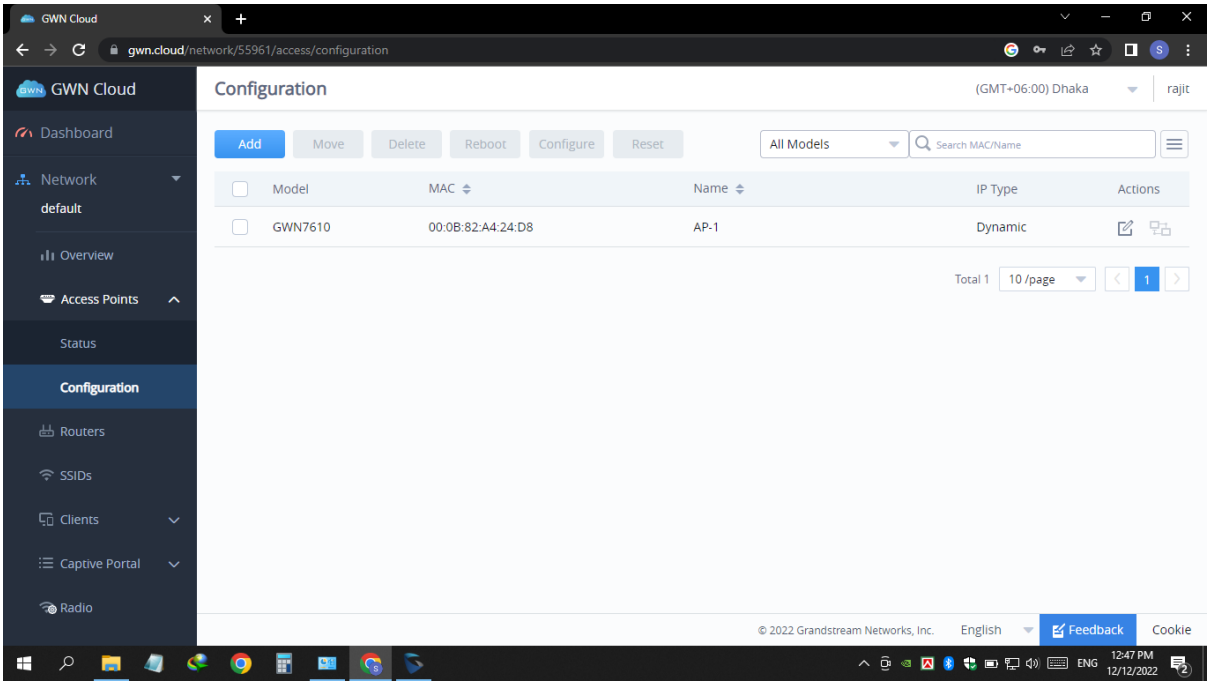


Figure 5.5.2: Configure

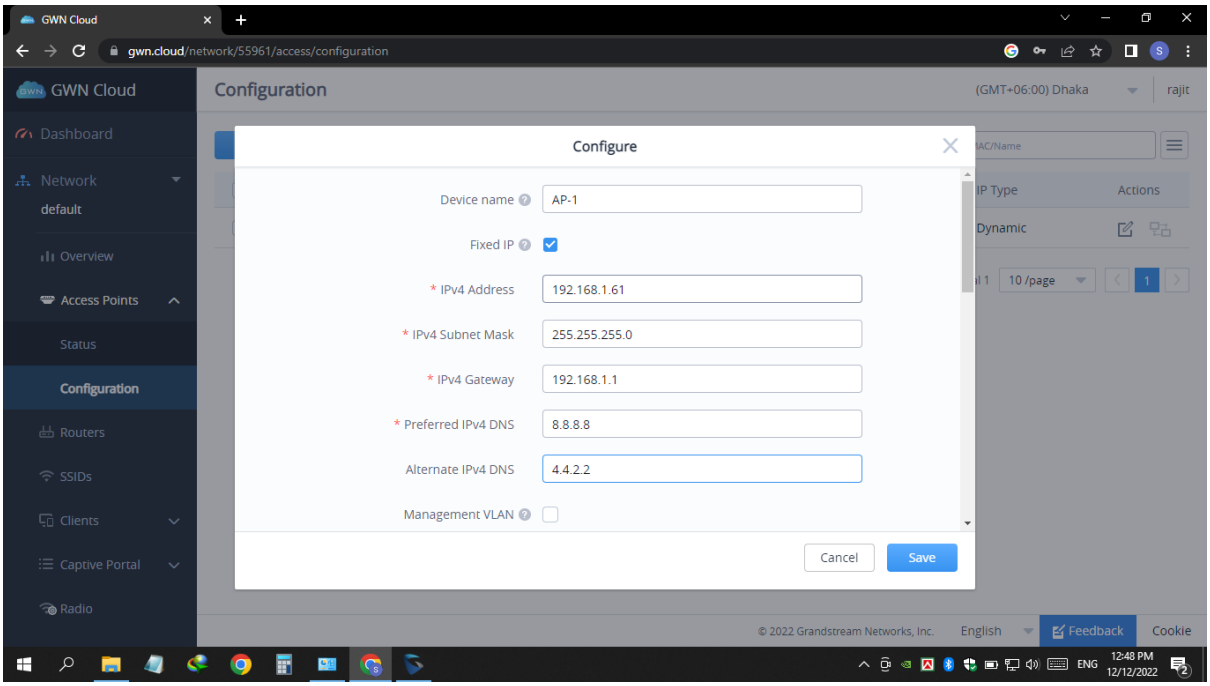


Figure 5.5.3: Configuration

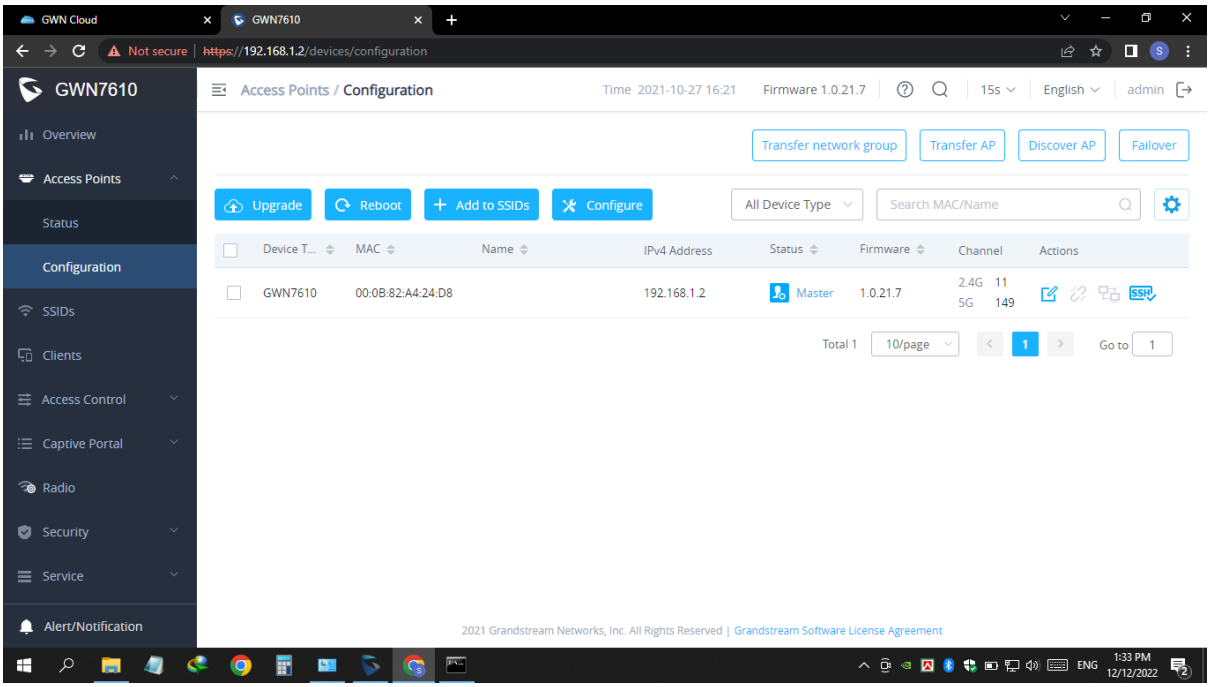


Figure 5.5.4: Add SSID

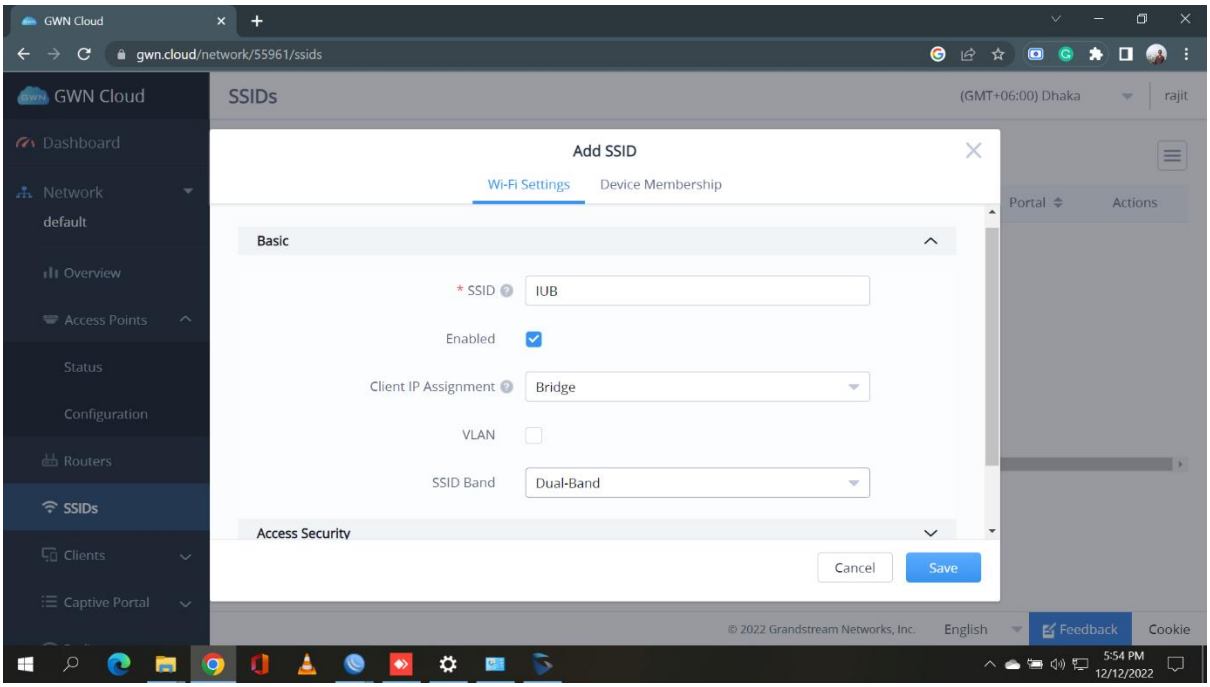


Figure 5.5.5: Add SSID

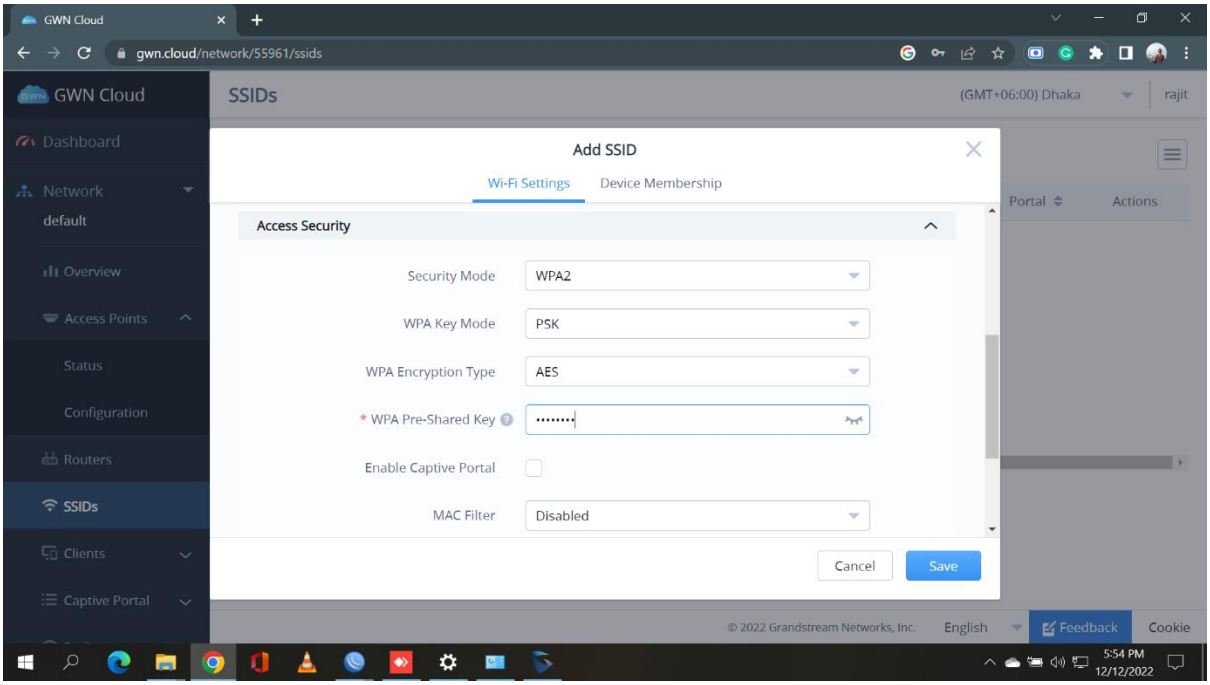


Figure 5.5.6: Client Status

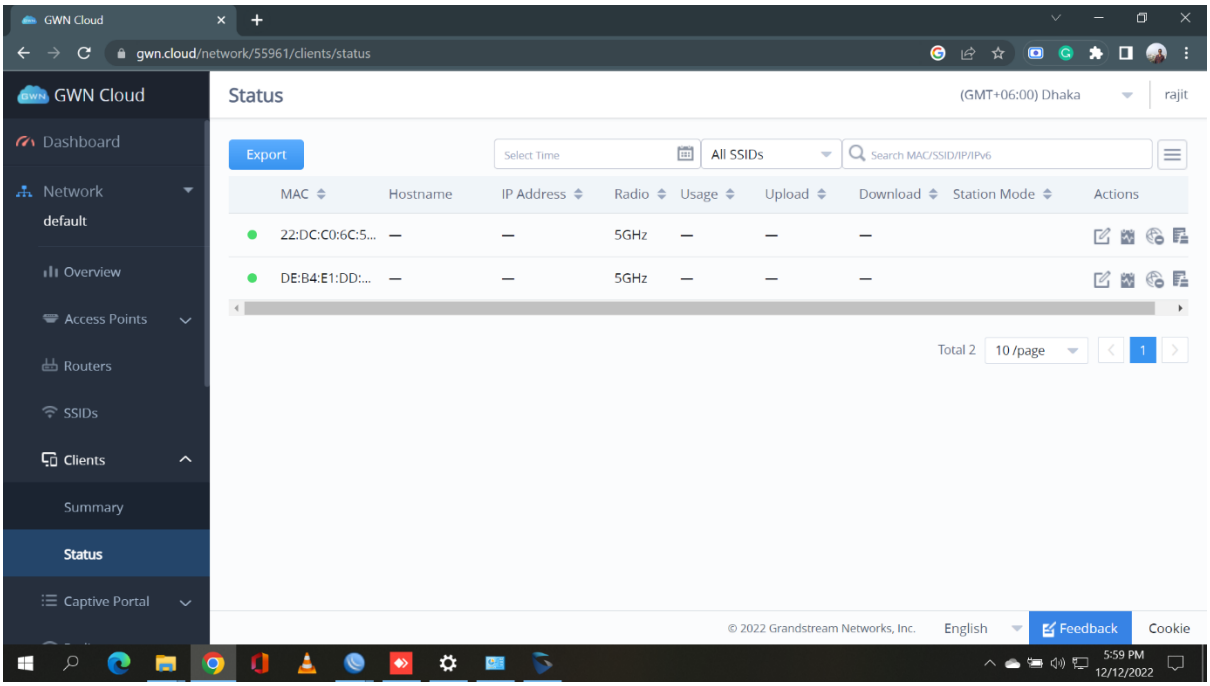


Figure 5.5.7: Add Voucher Group

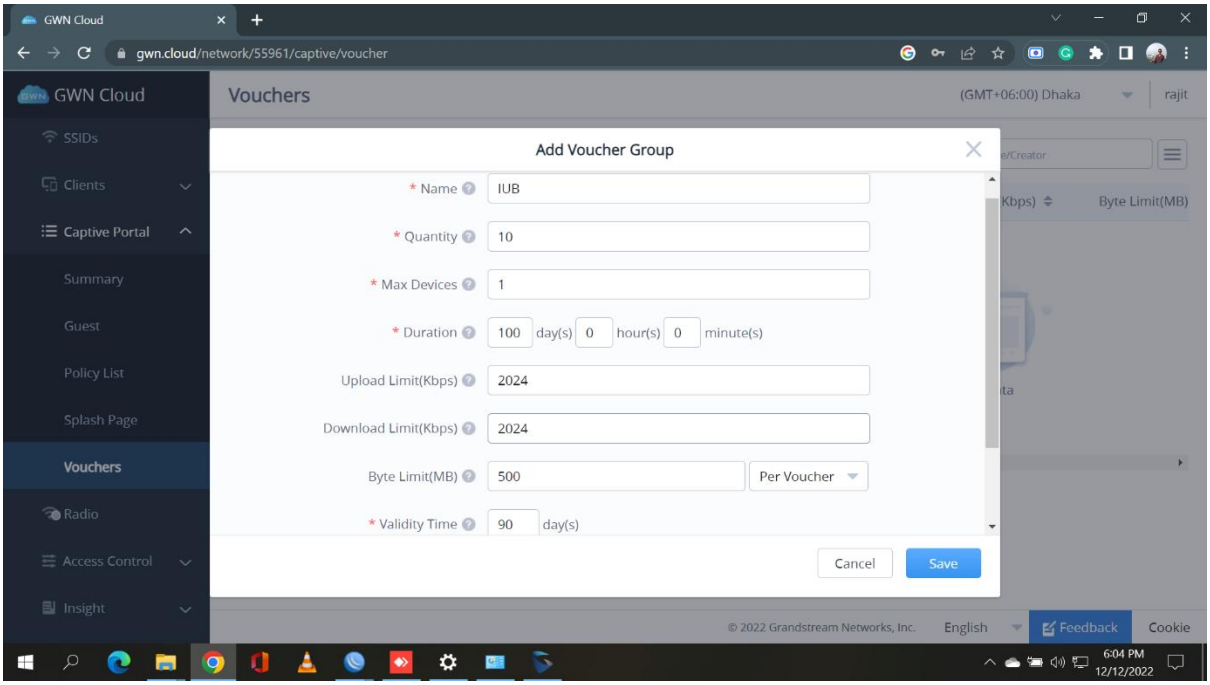


Figure 5.5.8: Vouchers

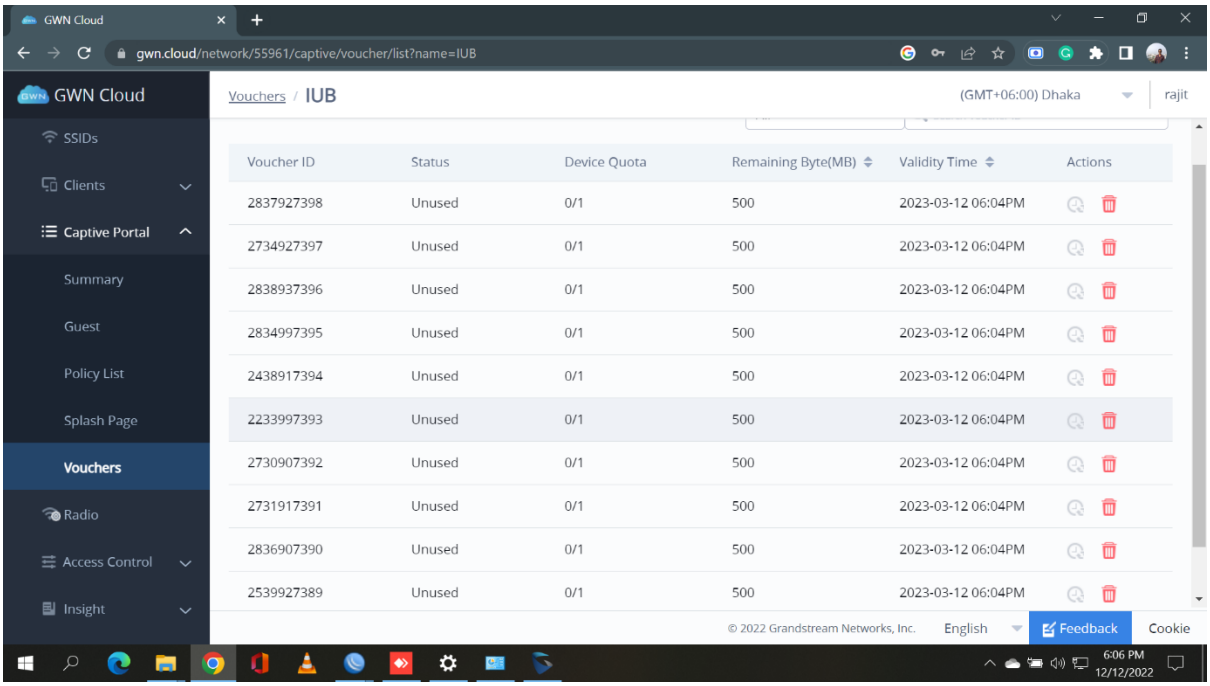


Figure 5.5.9: Add New Schedule

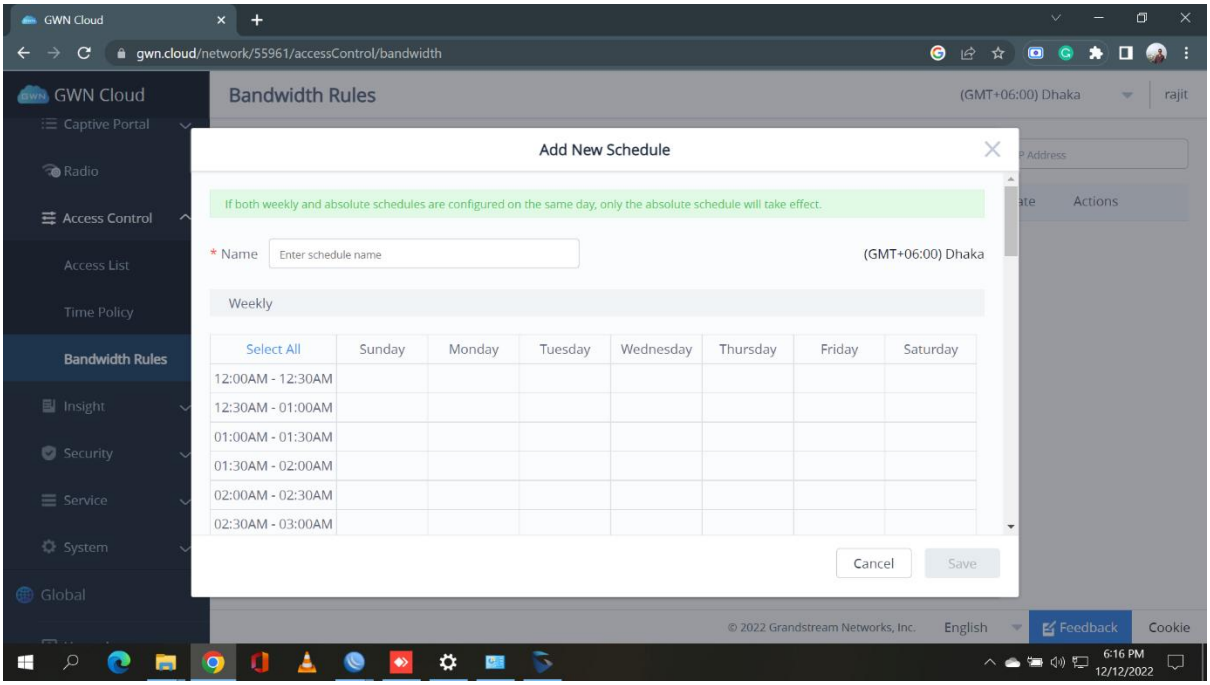
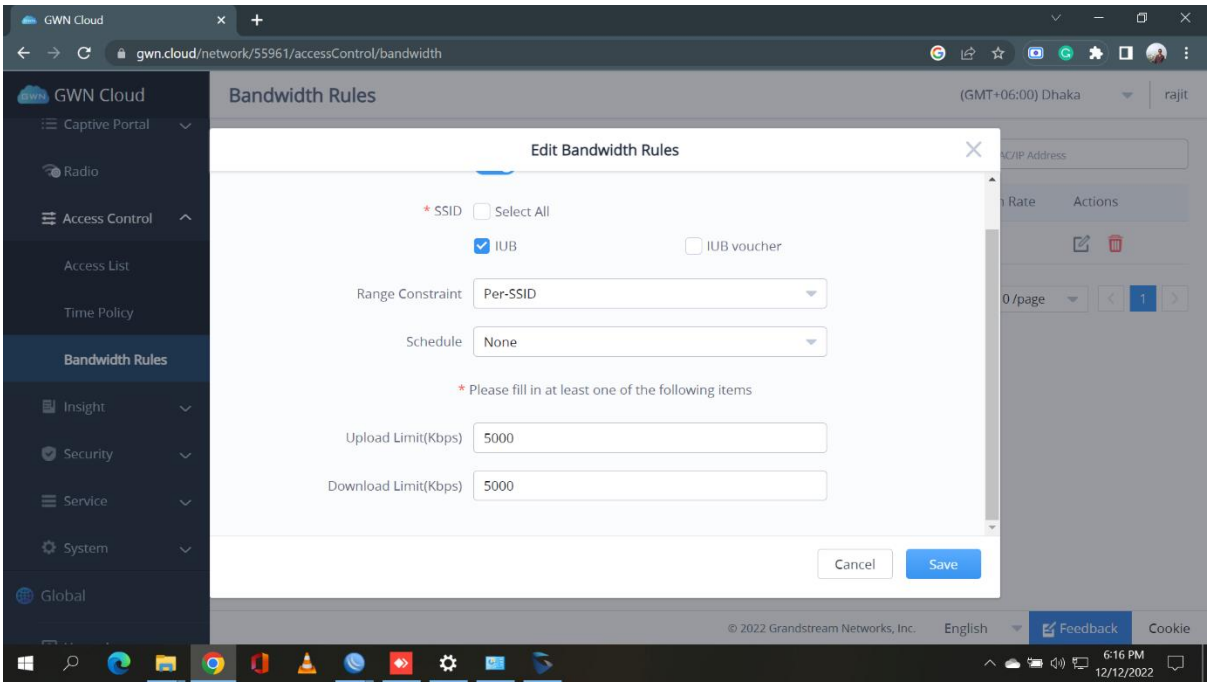


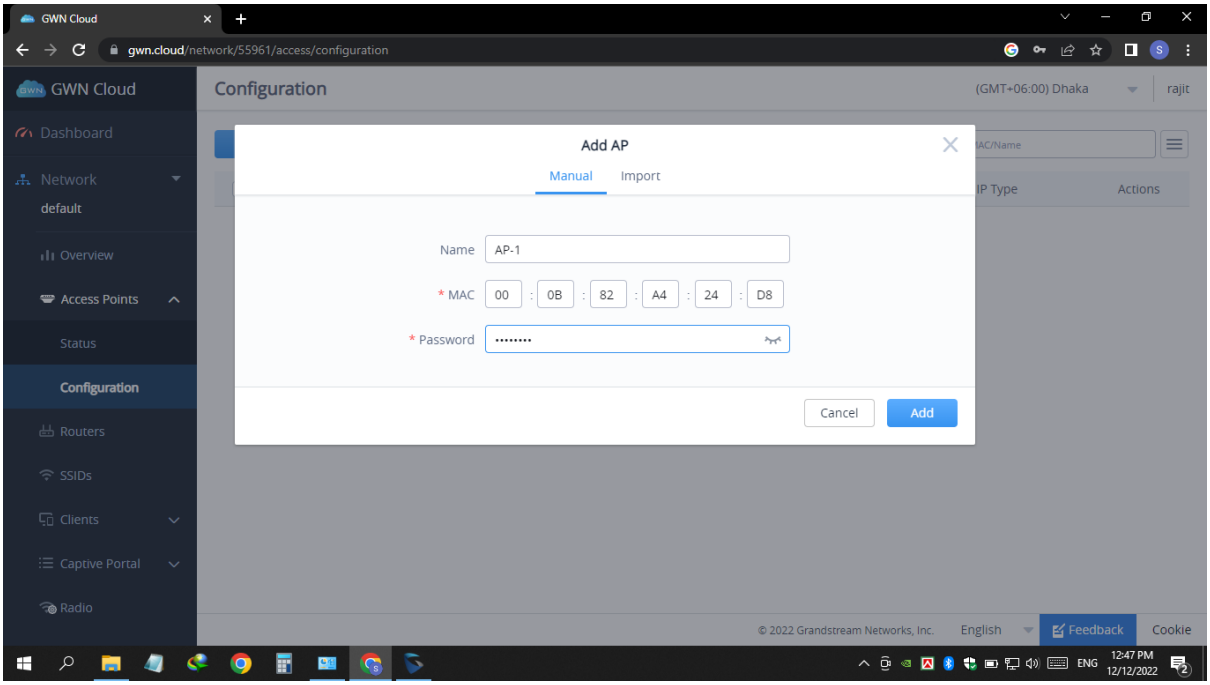
Figure 5.5.10: Edit Bandwidth Rules



5.6 Testing

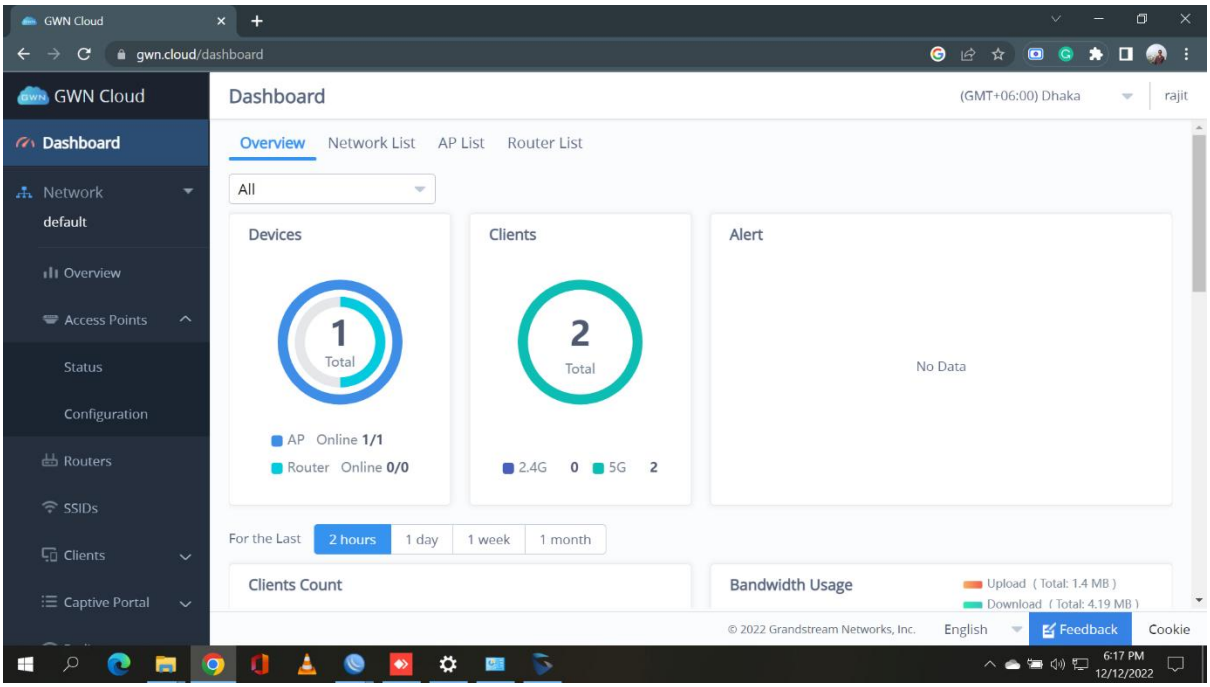
5.6.1 Input

Figure 5.6.1: Add AP



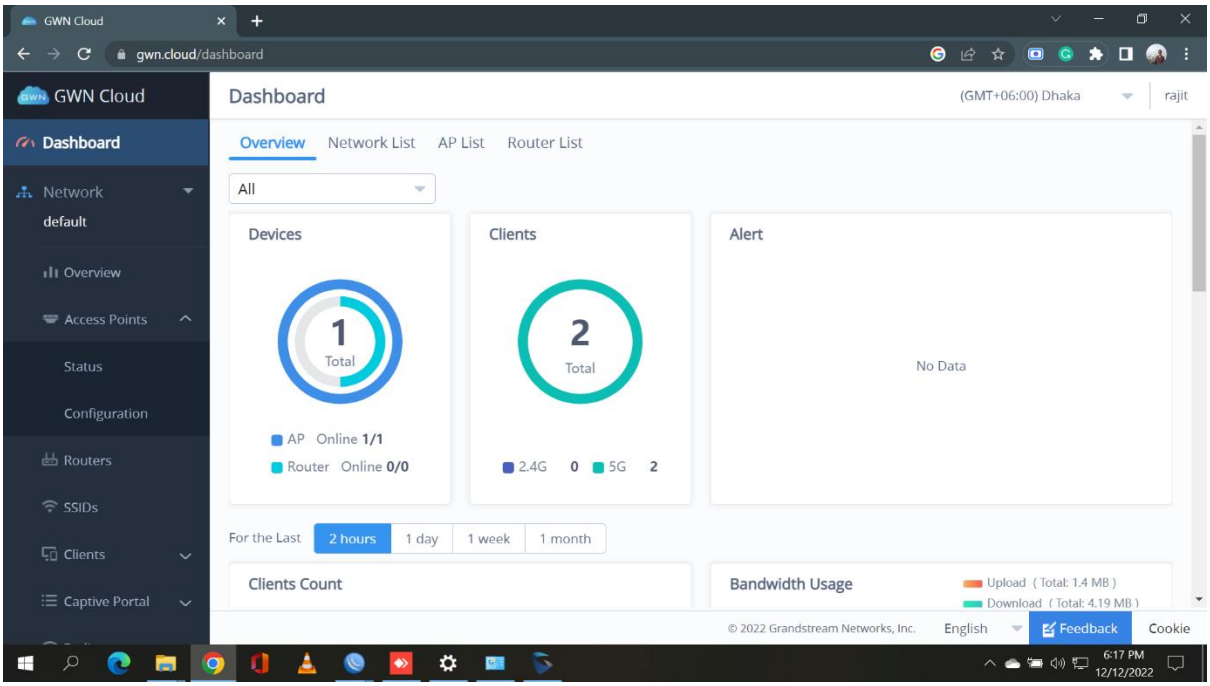
5.6.2 Output

Figure 5.6.2: Dashboard



5.6.3 Designing Test Cases

5.6.4 Test Results



Chapter 6

Results & Analysis

The company’s network department is in charge of the project "enterprise wireless network solution". The initiative primarily depended on providing network access to office workers. Here, I'll talk about the analysis and results of the projects. We wish to spread the network among the staff with the aid of the AP. We attempt to properly configure the AP first for covering huge area of internet. If it is for work, the customer will have access to the internet via their usable devices. In the GWN cloud, we also offer a guest section where the administrator can manage the network setup. Actually, there is work being done on the one-time use voucher option for guests. which have a time restriction, a duration, and a validity. We can also regulate the access point's bandwidth by selecting the range restrictions that have a single SSID, single mac, single IP address, and a single client. administrators may select any option from this section with the help client’s opinion, and administrators may enable or disable it. The wireless frequency, either 2.4GHz or 5GHz, is likewise at the admin's discretion. The project was for a buying house, and the networking engineers worked for Global Informatics Limited. The access point setup for the office worker looked like this. In the near future, this project will produce considerable results for Global Informatics Limited.

Chapter 7

Project as Engineering Problem Analysis

7.1 Sustainability of the Project/Work

Project sustainability is a practice that is currently very well-liked. The current world uses wireless network solutions. Internet access is necessary for office workers to operate comfortably. An office operates like a community. This wireless network system is essential for the convenience of a community. Because of its strong connectivity, which spans a big region, any office worker may effortlessly use the internet without experiencing any leakage. This GIL initiative enables the workplace community to function effectively. There is no need for routers to spread the internet because it is a profitable project and covers a large region with a few access points. The office will require maintenance assistance after the renovation is finished.

7.2 Social and Environmental Effects and Analysis

Social: The enterprise wireless network's primary goal is to provide widespread internet access. The GWN cloud system is managed by an administrator and extremely user-friendly when connected to an internet access point. This project has a positive social influence on the workplace.

Environmental: This enterprise wireless network has no negative effects on the environment. There is no need to pollute the air to expand the internet. Few AP are required to cover a large area, which is why plastic and semiconductors are not employed frequently.

7.3 Addressing Ethics and Ethical Issues

In the age of data harvesting, hacking, cybercrime, and other issues today, it's critical to keep in mind some unsaid principles and ethics when developing and releasing a product. We ensured that there were no behavior infractions and that all remarks were carefully considered.

The GWN cloud system can only be managed by admin, thus the data of visitors and employees is secure here. Personal data security is one of the most urgent issues in the digital era because of the sensitive information that our clients entrust us with.

Chapter 8

Lesson Learned

8.1 Problems Faced During this Period

It was also quite challenging for me to learn in the workplace because I had to put in extra effort to take in and comprehend my work. Although they are helpful, the coworkers are frequently busy due to their own deadlines. Since I had prior experience working for a large organization, I have encountered some difficulty adjusting to the work atmosphere and corporate culture. It was quite challenging for me to continue producing at the same rate as the rest of the team. because they are very knowledgeable and experienced in their industry. My official hours were from 9:00 am to 6:00 pm, therefore I was forced to work those hours. It was challenging for me because of my inexperience, but I like it.

I don't know anything about the GWN cloud infrastructure or access points for my project. To learn new technologies for this project, I need to put in some work. Due to the MAC address and password that are associated to the AP, we don't need to configure the access point if there is no physical AP.

According to me, three months is not enough time to adjust to and comprehend the complete workflow and operations of an office that is involved in so many various projects and departments. I found it quite difficult to handle office work and the surroundings. My attention was focused on how to interact with each person in the office.

8.2 Solution of those Problems

For my workplace, I interact with my coworkers through communication. Develop some soft skills in me so I can function in a professional setting. I was able to talk with the office staff, who shared their knowledge with me because I am a quick learner. The office workers make the office hours the most entertaining.

I used my project to gain field experience for AP configuration. where I receive AP configuration training in a Buying house. Learn some hardware as well for my project. I learn how to use the MAC address and password from the AP and gain access to the GWN cloud system while also configuring the AP.

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An Undergraduate Internship/Project on Enterprise Wireless Network Solutions for Global Informatics Limited

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Autumn, 2022

Consent from Supervisor

The student modified the internship final report as per the recommendations made by his/her academic supervisor and/or panel members during and/or before final viva, and the department can use this version for archiving as well as the OBE course material for CSE499.

(Signature of the Supervisor)

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