

Acknowledgement

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Abstract

The prime objective of this report is to intend and deploy a wireless LAN (Local Area Network) in a SOHO ambience. As a network consultant, the goal is to administer an appropriate resolution for an IT company named **Utopia Tech**. Utopia is a SO(Small Office), established with the aim of providing gratifying assistance to clients utilizing advanced & innovative technology in every possible way. This report about WLAN infrastructure design incorporates details about site survey, utilization of site survey tools, designs, justifications and consideration of hardware, software and other ample information. Likewise, the project further comprise of security requirements during the WLAN deployment along with crucial features like reliability, scalability and easily maintainable for future use. Scant obstacles during the process are carefully taken care of and appropriate actions are taken in order to avoid them from the deployment process.

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1.0 Introduction

Internet, also known as 'Net' is a globally connected wide area network system that permits users to communicate and access the required data from anywhere around the globe. Internet, being so powerful, draws people within it for some kind of interaction. From logging on to a social newsfeed to be updated or with expectations of sociability, internet is an indispensable part of one's life (Porter, 1997). All these connections are provided in multiple forms which also includes Wireless Network. Wireless network is further broadly divided into four major types: Wireless PAN, **Wireless LAN**, Wireless MAN and Wireless WAN.

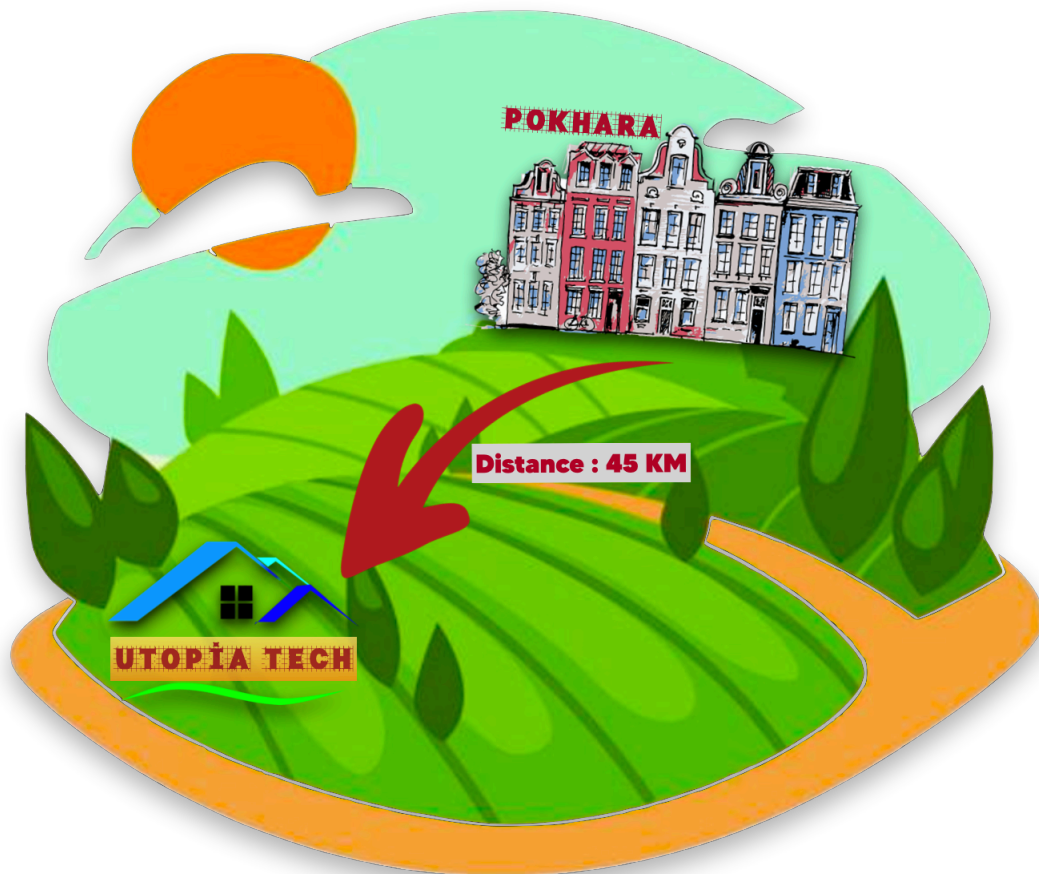


Figure 1 : Overview Location of Utopia Tech (Pngio.com, 2021)

1.1 Background

WLAN, also known as **Wireless Local Area Network** is a wireless communication that uses high-frequency infrared radio waves, in order to establish connection between devices or to convey data from one point to other, without wired cables. The foremost aim is to deploy a wireless LAN in the premises of Utopia Tech. This is to assure that staffs and visitants can access strong internet communication along with required softwares. So, the site survey is conducted applying requisite tools and selection of hardware and software is recommended with applicable justification.

1.2 Assumption

During analysis and deployment study process, following assumptions were put together for Utopia Tech :

- I. The area of Utopia Tech is estimated to be around 1800 square feet.
- II. The office is located at the distance of 45km from Pokhara Metropolitan City.
- III. There are total of four rooms which includes lobby and reception area.
- IV. Currently, 12 employees work in Utopia Tech. Everyone working in the office as well as guests are to be provided with the network access.

1.3 Scopes and Limitations

Project Scope

Some of the project scope brought up are given below:

- I. Implementation of WLAN Network with conduction of site survey and selection of appropriate hardware and softwares.
- II. To establish easy way of communication in between departments and with co-offices.
- III. Customers and staffs can be facilitated with mobile and swift internet connection for their work.

Project Limitations

- I. Occasionally, environmental intrusions also fabricate barriers in network connection.
- II. Undesignated Budget for the project create doubts while choosing the appropriate hardwares and softwares.

2.0 WLAN Site Survey

In order to acquire required information, a physical survey of the site territory is conducted. This is called **site survey**. A standard wireless device with testing tools is used to examine coverage, propagation and factual performance of WLAN network(ZVANOVEC et al.,2003). Moreover, site survey conduction is helpful in spotting interference which further intercepts, confinement of radio frequency. A formal interview is conducted to congregate data and suitable placement of cables, access points and other appliances is studied. As per the recommendation of Cisco, relevant knowledge of IEEE 802.11 Wireless and Wireless LAN Design is advantageous in conducting a effective site survey.

2.1 Site Survey (Types and Process)

There are three major types of wireless site surveys: passive surveys, active surveys and predictive surveys.

1. **Passive Survey** : This is the type of site survey that is performed in listening mode. Application passively pays attention to WLAN traffic and discovers level of noise, signal stability and functional access points.
2. **Active Survey** : This is the type of site survey where wireless adapters are linked with access points, in order to take measurements of throughput rates, retransmissions, packet loss and other crucial details.
3. **Predictive Survey** : This is the type of site survey where RF environment is created without any on-site computation.

Comparison between different Site Survey methods are demonstrated in table below:

WLAN Site Surveys	Passive Surveys	Active Surveys	Predictive Surveys
Description	During passive survey, an application passively listens and detects active access points, interference and signal strength.	During active survey, the Wi-Fi adapter is affixed to wireless network which computes data like, throughput rates, packet loss, etc.	During predictive survey, no on-site computation is done but a RF environ replica is constructed using computer simulation.
When to Conduct	Passive surveys can be conducted anytime as this procedure incorporates crucial WLAN characteristics	Active surveys are usually conducted when factual functioning of WLAN is required.	Predictive surveys are usually conducted prior to deployment so that WLAN feature can be simulated.
Hardware Requirements	MacOS: Built-in adapter functions well in application. Windows: Suitable wireless adapter.	MacOS: Built-in adapter functions well in application. Windows: Suitable wireless adapter.	Wireless adapter is not necessary. However, a fast multi-core CPU is recommended.
Software Configurations	No	MacOS: Selection of WLAN that falls under <i>Preferred Network</i> . Windows: Creating Windows Profile.	No
Data Collection	Application passively listens for packets.	Linking Wi-Fi adapter to wireless networks.	Data simulation with virtual surrounding.

Table 1 : Comparison between types of wireless survey

(Site Survey Tool - TamoGraph - Understanding Survey Types: Passive, Active, and Predictive, n.d.)

2.2 Requirement Elicitation

Requirement elicitation is an investigative process of accumulating essential data with continual interactions with relevant stakeholders. The process includes genuine exploration and documentation of information that clarifies what the project demands for its realization. With effectual interaction with end users and stakeholders, necessary requirements are gathered about what and how the project should come in execution. Moreover, requirement elicitation also results in evident functional requirements of project.

Depending upon the condition and type of projects, there are several methods that can be used to collect information from relevant users, clients and stakeholders. Requirement gathering are performed in following ways:

2.2.1 Business Requirements

Stakeholders Requirements :

- The deployment planning should be economically and practically feasible
- There should be no complaints about network connectivity from employees or clients
- The deployed hardwares / softwares should be scalable

Functional & Non-functional Requirements :

- The WLAN system should be efficient and support high number of nodes
- The deployed system should cover all office with strong internet connection
- The deployed WLAN must be highly secured from any possible threats
- WLAN policies should be enforced to make connection safe for users

2.2.2 Interviewing Stakeholders

In order to acquire more guidance, direction and assemble additional requirements, an interview including questionnaire is conducted with employees and clients. The figure below displays few questionnaires which are asked while interview process.

SITE SURVEY QUESTIONNAIRES

1. Has the company ever participated in site surveys before?
 Yes No
2. What are your expectations from the wireless LAN Network?

3. Are documents (eg. Floor plans & blueprints) of the office available?
 Yes No
4. What is the estimated number of clients that will access wireless LAN Network?

5. Are there any specific requirements for hardware and software tools to be used?
 Yes No → [If yes] _____
6. List down all the coverage areas required for the wireless LAN Network.

7. What softwares are used substantially in the office?

8. What barriers are there to cause any sort of RF interferences?
 _____ Nothing detected as of now
9. In average, what is the maximum bandwidth required by a user?

10. Select the types of devices that clients are expected to use on deployed WLAN Network?
 Desktop Tablets Mobile Phones
 Printers Range Extenders [Any other devices] _____

Figure 2: Questionnaire Form used during Site Survey

2.2.3 Determining Physical & Data Security Requirements

When the usage of network increases, security requirements are to be upgraded as well. Both, physical as well as data security are crucial in order to use the network with reliability and without inconveniences.

Issues within Radio Frequency, such as freezing and detachment of connection between devices must be carefully studied. Shielding constituents with metal or glass wares can solve physical security complications. Likewise, for data security, transmission of data must be sealed and unambiguous, which can be done with different virtual network technologies.

2.3 Site Survey Types (Analysis and Recommendation)

After all the obtainable requirements are gathered, a feasibility study is conducted in order to analyze the most effective and appropriate method of site survey.

Regarding technical feasibility, active site surveys are found to be most advanced. Precise measurement of signal propagation and radio-frequency makes this process effectual, as it covers contents like walls, furnitures, ducts and other influential elements. Similarly, in terms of operational feasibility, active site survey is pretty efficient as it computes real throughput rates and performance of every access point placement. Contrastingly, the economical feasibility determines passive survey to be the most economical one as it requires few manpower and easy to conduct among all three types. Predictive surveys can be commanding when there are complications in accessing the site location(Sauter, 2018).

Out of all three types of site surveys (Passive Survey, Active Survey and Predictive Survey), the chosen type is **Active Site Survey**. This is because active survey provides precise statistics about performance for every access points and guarantees the installation process. Moreover, despite being labor intensive, active site survey requires very few number attempts to conduct the site survey process.

2.4 Current Site Design and Details

As a network consultant, a well planned process is required in order to implement the WLAN Network effectually. For this, a comprehensive study is done by constructing an appropriate design, where all the requisite factors are considered.

2.4.1 Physical Location & Characteristics

Floor Plan of Utopia Tech

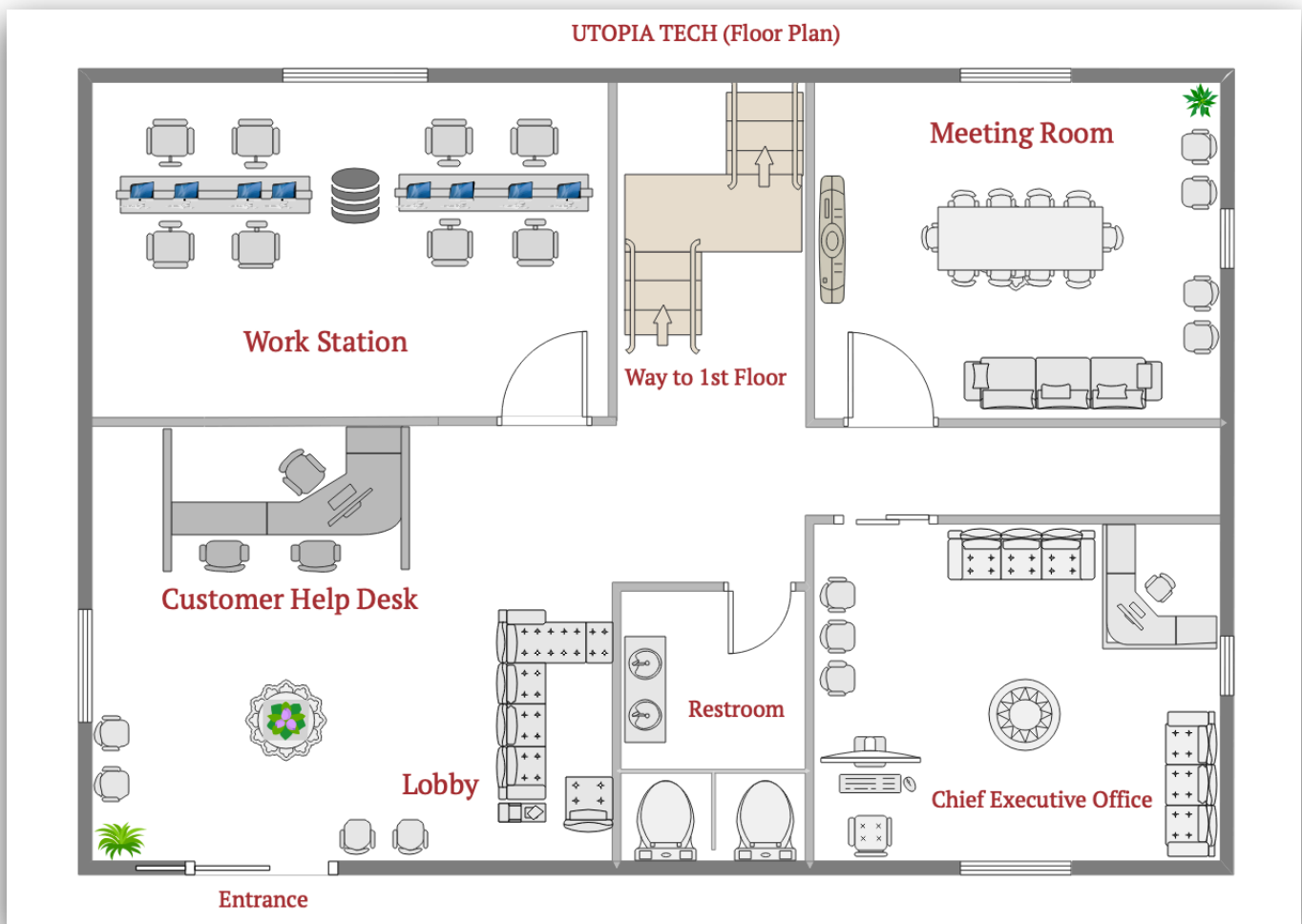


Figure 3 : Floor Plan design of Utopia Tech

2.4.2 Obstacles within the Site

While studying the floor plan of Utopia SOHO circumstances, several barriers that affects which affects wireless signals are discovered. Generally, physical obstacles are supposed to cause excessive interferences, having impact on network coverage, standard and eventually on performances. Frequency is measured using frequency bands of certain ranges and essential rectifications are done.

Obstacles	Descriptions
Number of Rooms in SOHO environment	4 Rooms
Building Walls : Thickness	4 inches
Material Used to Manufacture (Walls)	Concrete
Windows	In each rooms
Furnitures Present	Desks, Chairs, Sofa, Separators
Material Used to Manufacture (Furnitures)	Glass, Metals, Plastics, Woods

Table 2 : Obstacles within the site

2.4.3 Intended Users

WLAN Network in Utopia Tech is intended for both staffs as well as customers usage. In order to develop a mutual relationship with clients and audiences, employees can use email and social media platforms with network availability. It will also be accustomed to manage reports and company's finances through applications like Freshbooks and Wave Accounting. Similarly, clients who visit office premises will also be facilitated with WLAN Network for their amenity.

Users	Minimum users at a time	Maximum users at a time
Office Employees	10	20
Clients	0	20
Hardwares	1	5

Table 3: Intended Users of WLAN Network

2.4.4 WLAN Standards and Consideration

Among 1100 or even more operative Wi-Fi standards maintained by IEEE, the 802.11 series standard is studied in detail, as it comprises every LAN (WLANs) and MAN standards(Notes, 2019). There are other handful of more standards which includes, 802.11a, 802.11b, 802.11g, 802.11n and 802.11p. Comparison between few of the considerable standards is demonstrated below :

IEEE Standards	802.11b	802.11n	802.11ac
Date of Release	September, 1999	October 2009	December, 2013
Frequency	2.4 GHz	2.4 or 5 GHz	5 GHz
Range	300 feet	175 feet	410 feet
Quality	Poor	Average	Decent
Cost	Average	Average	High
Multi-user Compatibility	Unavailable	Unavailable	Available
Interference	High	High	Average
Data Rate (Max)	11 Mbps	450 Mbps	1.73 Gbps

Table 4 : Comparison of IEEE Standards

Observing all available wireless standard variations, the recommended one is **IEEE 802.11ac**. One of the foremost motive to choose this particular IEEE standard is because of its broad acceptance proportion among devices like routers and modems. Use of Multi-User MIMO in 802.11ac enhance the network potentiality while its modulation ventures brings 33% inclination in data ratio. Furthermore, 802.11ac provides more than thrice the pace of 802.11n and operates extensive bandwidth which ranges in-between 80MHz - 160MHz (Advantages of 802.11ac | Disadvantages of 802.11ac, 2019).

2.4.4.1 Antennas

Antennas are crucial components of WLAN system, that uses converted electrical signals to facilitate wireless signals. The transferring and receiving antennas presented in wireless devices transforms EM packets into electrical signals.

Wi-Fi antennas are categorized into 2 major types :

- i. Omnidirectional**
- ii. Directional**

After studying both of them, the chosen antenna for our site is **Ceiling Dome Antennas**. This is because the office will have devices like laptops, PCs and printers in use and also there will be other obstacles to create certain interference within the site. Appropriate location is selected in the ceiling and the antenna is installed with necessary measurements.

2.5 RF and Speed Considerations

During the deployment of WLAN Network, the range and tempo of radio-frequency are reckoned essential. There are several factors that plays a part in alteration of radio-frequency. Apart from all those physical obstructions within the site, some of other effectual factors are specified below :

2.5.1 Coverage

The WLAN Network coverage is one of the crucial part to focus on during the deployment process. It determines whether users can get sufficient network on their device to use high level standard connection. The area (size) of SOHO taken into consideration during the deployment and required access points, signal strength and data rate are studied in order to maintain sufficient coverage within the building.

2.5.2 Applications to be used

Utopia Tech, being a startup IT office will use several different applications with the intent of facilitating staffs as well as customers. However, some of the major applications that will be used are :

Application Names	Usage
Microsoft 365	To communicate, host conferences and share documents with clients and staffs
Google G Suite	For professional emails, storage and document sheets to company employees
Slack	As Customer Relationship Management (CRM) and for marketing purpose
Visual Studio Code	For coding and other backend purposes
Adobe InDesign and Photoshop	To create graphics, magazines, flyers and other materials
Microsoft Access	As a database software to store accounts, articles and information

Table 5 : Applications to be used in SOHO business

2.5.3 Line of Sight

During WLAN deployment, propagation of radio signals between transmitter and receiver is considered to be significant. In Line of Sight, the transference occurs when both transmitter and receiver are open without any barriers in between them. However, in empirical life this is pretty much a unrealistic task, not just because of physical obstructions, but also because of natural factors. There are generally two Line of Sights (LoS) : Visual and Radio. Visual LoS refers that a transmitter visualizes the receiver while Radio LoS refers to transmission of radio signals (CAPANO, 2021). During the deployment process, LoS between two stations is studied along with chosen router and any other selected devices. But since there are a lot of physical obstructions within the site, Radio LoS can be considered as a superior option.

2.5.4 Interference

Radio Frequency Interference (RFI) is the intrusion caused due to excessive radio spectrum occupancy. RFI occurs because of high amount of transmitters, monitors or even amplifiers. This causes disarrangements of connections during communication, mislaying of assistance as well as detain in information throughput (Whitlock, 2020).



Figure 4 : Data Flagging Equipment (Innoo Tech, 2021)

Data flagging (RFI detection) is done in the site using an appropriate RFI detector. For this project, 'Innoo Tech RFI Detector' will be used considering its impressive agility and accuracy. By focusing on appropriate routing without needless flooring and with hefty gauge cover wires, interference within the cite area can be controlled.

WLAN Interference :

The performance of selected wireless standard (IEEE 802.11ac) is disrupted by other networks as WLAN interference. Taking network IEEE 802.15 which encompass IEEE 802.15.1 (bluetooth), it distorts the performance of IEEE 802.11ac through the FHSS hops. While bluetooth embrace whole 2.5 GHz band completely, IEEE 802.11ac on the other hand barely surrounds half of 2.5 GHz band. This creates collision among the networks, which ultimately plunges the performance of IEEE 802.11ac. Other than proximity or bluetooth devices, there are other source of interference such as Microwave oven interference, Radio signals interference, Cordless phone interference and so on (Cisco Press, 2015).

As a network consultant, appropriate measures is taken during the WLAN planning to avoid this issues. Devices like microwave oven and cordless phone will be kept away from Access Points while wireless cameras should be located in appropriate distance from WLAN devices to avoid interference (Huawei Support, 2019).

2.5.5 Environment

Environment is also one of the elements that affects network interference. There are a lot of environmental factors that disrupts the WLAN performance. This involves reflection, diffraction, scattering, refraction and absorption. These factors hampers radio frequency, amplitude, bandwidth and wavelength of a network. To avoid interference because of these environmental problems, placement of Access Point in the site is planned in appropriate position. Furthermore, minimization of usage of glass or similar products might also aid in reducing the interference in the site.

RF Justifications and Considerations

There are several things to be considered during RF deployment process. Since the distance between access points can give rise to disparity of throughput, the data standard of access points must be kept in limit. Likewise, the way radiation can be determined is when end users test in repeatedly.

2.6 Site Survey Software

The software used to conduct site survey for Utopia is, **Ekahau Site Survey**. Operating efficiently for all network ranges, this software is supported both on Windows as well as Mac OS. There are several features such as auto detection of access points. that made us choose this specific site survey tool. It would help to generate maximum performance from the network.

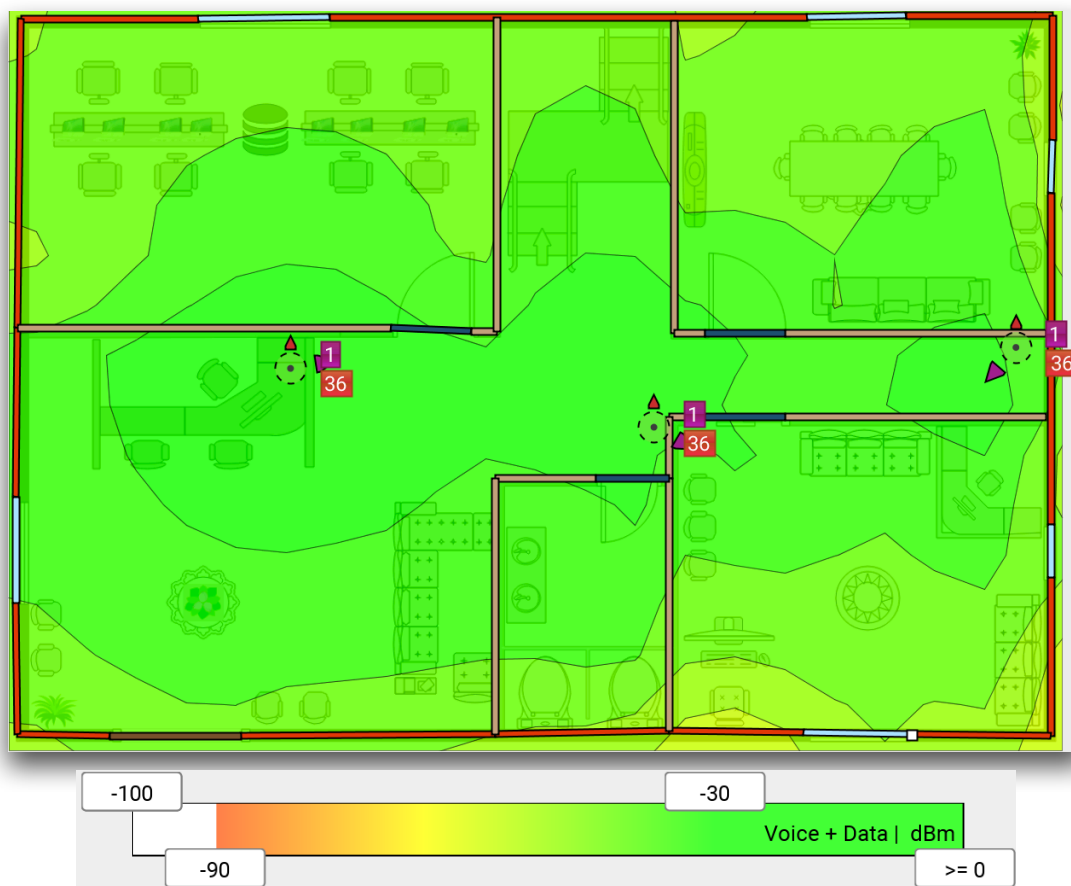


Figure 5 : Heat map view of Site Survey

3.0 Hardware and Software Requirements

To achieve finest quality of internet facilities in Utopia tech, high quality hardwares and softwares must be deployed, considering the financial limitation of the SOHO tech company. As a network administrator, number of hardwares and software systems are recommended along with relevant justifications.

3.1 Recommended Hardwares

In terms of hardware, we have several networking devices such as routers, access points, ethernet cables, wireless bridge and controller. Necessary comparisons are also done along with their justifications.

3.1.1 Routers

Recommendation and Justification

The recommended router for WLAN deployment in Utopia Tech is Synology RT2600ac. It is a quality-rich router, supporting double WAN connectivity with MU-MIMO data streaming. It is easy to install and distributes unbroken 2.4GHZ and 5GHz throughput. The scalable RT2600ac comes with business-grade protection and functions together to cover the surrounding, enlarging the network availability in every corners of office.



Figure 6 : Synology Router RT2600ac (Synology Inc., n.d.)

Supporting wireless type of 802.11ac, the RT2600ac facilitates with WPS2, WPA-PSK, WPS, WPA2-PSK and also WEP security protocol. Data transfer rate of this router is 1 GB/sec and the voltage is about 120240 volts. Furthermore, the hardware has surface coating of 7 traffic authority and it also has sharp connection for conversion between utmost range and speed. To clarify the effectiveness of chosen router, a spec comparison is also done with other available options. This allows clients to see the difference between them clearly and have their say during hardware selection.

Router Models	Netgear RBK853	Synology RT2600ac	ASUS RT-AX88U
Router Brand	Netgear	Synology	ASUS
Model No.	RBK853-100EUS	RT2600AC	RT-AX88U
Operating System	Windows	Windows	ASUSWRT
Connectivity Type	Wi-Fi	Wi-Fi	Wi-Fi
Wireless Type	802.11ac, 802.11b	802.11ac	802.11a
Battery Inclusion	No	No	No
USB Ports	2	2	8 (ethernet ports)
Product Weight	3.9 kg	700g	1.01 kg
Product Price	\$642.33	\$199.46	\$349.99

Table 6 : Comparison of router functionalities

Looking at the comparison table, both Netgear RBK853 and Synology RT2600ac supports our recommended IEEE Standard (802.11ac). However, the price of Netgear RBK853 and ASUS RT-AX88U is too much for a small SOHO. Therefore, with provided justifications and above comparison, Synology RT2600ac is chosen as it seems to be a feasible option both technically and financially.

3.1.2 Access Points

An access points is used in Utopia to connect router with the help of ethernet cable so that WLAN connection is available in projected area. In Utopia Tech, access points are placed in work station area, reception and in meeting room as well. Access point in work station will allow developers to work in an environment having a strong internet connection. Likewise, according to stakeholders, the meeting room usually hosts high number of people in regular basis. So, it can be a place which might be advantageous to meeting attendees.

Recommendation and Justification

In terms of Access Points (AP) selection, Ubiquiti UniFi Pro 802.11ac is the recommended one. This 1.75 pounds scalable access point comprise of UniFi controller, that optimizes RF performance for strong network connections. It is a 802.3af powered AP that is portable for both indoor as well as outdoor operation along with weather resistance support. Likewise, it supports the latest 802.11ac IEEE standard technology along with 3X3 MIMO tech that inclines antennas for transmission and receiving to upgrade WLAN connectivity.



Figure 7 : Ubiquiti UniFi Pro 802.11ac Access Point (telco.sydney, n.d.)

The spectral analyses in Ubiquiti UniFi Pro gathers feedbacks on entire 5 GHz while its band steering drives users to quicker interferences. According to expert reviews, this is a hard AP to deploy or set up. But once the AP is set up by network administrator, unlimited scalabilities are provided based on its software. It has 2 10/100/1000 ethernet ports and provides 1300 Mbps with 5 GHz speed. Moreover, basic comparisons with other similar access points are given :

Access Points Model	Linksys LAPAC2600	Hawking 1200AC	Ubiquiti AC Pro
Product Brand	Linksys	Hawking Technology	Wasp Technologies
Product Weight	1.89 pounds	1.54 pounds	1.75 pounds
Product Dimensions	9.57 x 9.33 x 1.72 ”	4 x 9 x 12 ”	7.74 x 7.74 x 1.38 ”
Voltage	12 Volts	12 Volts	12 Volts
Warranties	No fixed period	No warranties	1 Year
Product Price	\$350	\$269	\$148

Table 7 : Comparison of Access Points functionalities

Despite having almost identical functionalities to other two access points, the Ubiquiti UniFi Pro 802.11ac Access Point is available in cheaper price compared to others. What's more is, the company is currently providing warranties, that allows stakeholders to choose the device without complications.

3.1.3 Cables

Considerations and Justifications

The use of cables in our deployment process is to connect Access Point to the router. To set up an Access Point, we can simply insert the cable into LAN port of router and connect it to main ethernet port of AP from the other side. This will provide access to share resources between multiple devices functioning under same LAN network.

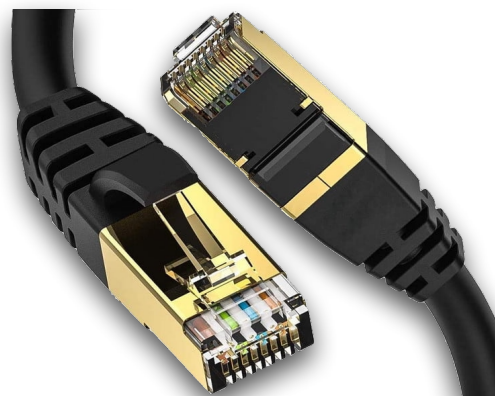


Figure 8 : DiBillion Da Ethernet Cable - Cat 8 (Parrish, 2021)

Since most of the ethernet cables are made up of copper and they use electrical signals for data transmission, possibility of electromagnetic interference occurs rises significantly. To prevent this, ‘shielded cables’ are used in order to cushion the wire from any sort of interferences or electromagnetic leakages. Ethernet cables are further categorized as ‘Cat’ versions along with their distinctive specifications. Apart from ethernet cables, selection of fiber optic cables is also considered for the side. Basic differences between these cables are demonstrated in table below :

Cable Category	Cat 6a	Cat 7a	Cat8	Fiber Optic
Shielding	Both	Shielded	Shielded	EMI / RFI
Transmission	Electromagnetic Wave	Electromagnetic Wave	Electromagnetic Wave	Light Pulses
Throughput	10Gbps	10Gbps	40Gbps	10Gbps
Bandwidth	250Mhz	600Mhz	2000Mhz	20Ghz
Cable	UTP / STP	STP	STP	Lucent

Table 8 : Comparison of available cables

The above comparisons clarifies differences between ethernet and fiber optic cables. There are few crucial features in Fiber Optic cables such as light pulses transmission, that makes them special. However, considering the fragile nature of Fiber Optic cables, the recommendation is to choose Ethernet cables : either Cat 7a or Cat 8. However, the talk about cables can be done with stakeholders in meantime and selected wisely without any obfuscation.

3.2 Recommended Softwares

Security Implementation Requirements

Like hardware, there are few significant softwares that are carefully considered during the WLAN deployment process. With increasing number of hackers and crackers everyday, the system must be prepared to defend any sort attacks at anytime. Firewall installation is considered to be one of the best method to stay away from network threats and anomalies. However, since this deployment is for a SOHO environment, usage of firewall does not make sense: financially and based on number of users. This is why, Intrusion Detection Software (IDS) and Antivirus are recommended with purpose of maintaining system security in Utopia Tech.

3.2.1 Intrusion Detection Software

An Intrusion Detection System (IDS) is a security software that diminishes security threats such as cyber-attacks and malware. Furthermore, IDS also blocks upcoming threats that might harm the system by accessing it in unauthorized way. The main reason to install an Intrusion Detection System in a system is because it alerts system administrator incase of any suspicious activities, by monitoring network traffic of the environment. The IDS is further classified into two major types : Host Intrusion Detection Software (HIDS) and Network Intrusion Detection System (NIDS).

IDS	Suricata	Snort	Open WIPS-NG
IDS Type	NIDS	NIDS	NIDS and HIDS
Attributes	Protocol monitoring, real-time tracing, third-party coalition, clever operation planning	Signature obstruction, real-time briefing, warning intelligence, packet logging and sniffing	Wireless special IDS, open-source tools, sensors, seize wireless congestions, info displaying GUI, server management
Cons	Complex installation	Risky upgrades	Limitations in NIDS
Business Type	For medium and large-sized business	For small and medium-sized businesses	For small and medium-sized businesses

Table 9 : Comparison of available IDS

(Top 10 BEST Intrusion Detection Systems (IDS) [2021 Rankings], 2021)

After analyzing all available Intrusion Detection Software, the chosen IDS for Utopia Tech is ‘**Open WIPS-NG**’ IDS. This is because the software is specifically built for wireless system protection and the available features matches our expectations. However, Snort IDS seem to have problems with scalability and Suricata is basically used in large scale businesses rather than SOHO companies like Utopia Tech.

3.2.2 Antivirus

Along with devices like laptops and smartphones, routers are also among the top targets for hackers lately. These network users can easily break the vulnerability of router to find sensitive data such as bank credentials and private information. These credential might further be used to steal or for other illegal works. To assure security to all WLAN users in Utopia Tech, installation of Antivirus is considered crucial. Some of the available Antivirus and their functionality comparisons are shown in the table :

Antivirus Name	F-Secure	AVG	Kaspersky
Anti-Phising	No	Yes	No
Anti-Banner	No	Yes	No
Anti-Spam	No	Yes	No
System Booster	No	Yes	No
File Shredder	No	Yes	Yes
Ransomware Security	Yes	No	Yes

Table 10 : Comparison of Antivirus functionalities

Considering the comparisons above, the **AVG (Antivirus Guard)** is an obvious choice as our antivirus software. The features of AVG that includes total internet security from phishing or spam is something we were looking for. The antivirus software further scans emails and mends virus-infected files to keep system secured. The online shield in AVG also guarantees the safety of data exchanges through instant messengers (Wikipedia contributors, 2021a). This way, the WLAN system can be brought into use, without any fear of being attacked or tricked.

Conclusion

The deployment process assured a detailed information about all the crucial factors, methods and procedures about Wireless Local Area Network setup. The site survey conducted during the WLAN deployment produced several learning opportunities and few complications to solve. Likewise, the project also created a chance to learn about network hardware and software in depth. In a nutshell, wireless LAN is deployed in a SOHO environment and internet can be accessed as well. External RF interferences were detected and necessary actions were taken to troubleshoot them and facilitated with the best possible internet coverage.

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