

MTW (NPI000047)

by Shivam Ranabhat

Submission date: 18-Aug-2021 04:07PM (UTC+0800)

Submission ID: 1632764750

File name: NPI000047_Shivam_Ranabhat.docx (1.43M)

Word count: 4036

Character count: 20890

1. Introduction

A wireless network or wireless LAN is a wireless computer network within a certain local area that connects two or more devices and also allow the connected devices to communicate, transfer data and file sharing to form a local area network. As wireless networks can provide faster connection, can afford easily and are simple to implement than before, small business that are in growing progress. And they are getting various benefits in case of productivity, increases the satisfaction in working field and application mobility becomes more flexible. Similarly, if a company grows from a small business, then they need to change the wireless infrastructure in such case wireless infrastructure are easier to reconfigure as the total cost of WLAN installation is cheaper which make it very affordable nowadays.

1.2. Project Scenario

According to the given project we are designated to work as an individual network consultant in order to operate a Wireless LAN in the environment of small office or home office having 10 to 20 staffs working there. Internet access including software like word processors and spreadsheet are supposed to be used with the help of Wireless LAN. So, to design Wireless LAN the step should be conduct a WLAN site survey to gather the requirements and information for the installation of wireless LAN. The major aim of conducting WLAN site survey is to examine whether the radio frequency outside the office create obstacle, reduces the number of access point and to know the best area to place it for coverage (SONICWALL, 2019).

In order to conduct a WLAN site survey, we should utilize the suitable site survey tools and techniques by visiting a small office or home office (SOHO). We should also create a technical report about what we have collect from the WLAN site survey including all the evidences.

With all the finding collected from the WLAN site survey we should propose WLAN infrastructure for the small office or home office. We also need to justify the hardware and software requirements needed during the installation.

1.3. Aim

The main aim of this project is to provide a good wireless LAN network which made all the staffs and heads of the laboratory to access internet with good speed and software like spreadsheet and word processors without facing any problems at the laboratory.

2. WLAN-Site Survey

2.1. Introduction

WLAN site survey which is also called radio frequency site survey is the process of analyzing, planning and designing a Wireless LAN which meets the requirement for network capacity, coverage, capability and quality of service it should provide.

According to the point of view explained above Wireless LAN is proposed to install which suitable for small office/Home office which supports both internet access and software used to keep records of the patients and researches for that we are proposed to utilize the site survey tools and techniques to collect the information about various obstacles that created problems with their solution and also about the suitable hardware and software that are required during installation of WLAN network.

2.1.1. Network Scope

The designed WLAN network should provide the internet access and also can be accessed for software which is used to store information and other purposes in the United Reference laboratory which is clearly mentioned in the project. Also, the main point is that the designed network should houses 10 to 20 employees.



Fig: United Reference Laboratory

2.1.2. Objectives

The WLAN network proposed for the laboratory should meet all the requirements which are listed below:

- i. Network Reliability
The proposed network should good internet connection and constantly better in performance whenever the staffs want to access it.
- ii. Network Security
The proposed network should be secured and protected as the software run with the help of the network contains customer and staff's private information which should be protected. During the installation it should be more focused that the network should not be easily attacked by the attacker.
- iii. Network availability:
The WLAN network should be available at any time as the staffs of the laboratory may work for late night so, it should be accessible at any time with constant speed all the time.

2.1.3. Requirement Gathering

To make the proposed network better and more reliable from the user side, appropriate interview was taken from the staffs and the patients who often visit the laboratory and following are the question asked during the interview to collect the additional requirement for the network which helps to eradicate the possible problems which can be face after installation.

- a. What speed could be enough for your laboratory?
- b. After the installation of WLAN network, Will it boost your accessibility to the internet and use of software?
- c. What are the major features you desired to have in new installed WLAN network?
- d. What types of application which are being used mostly?
- e. What are the maximum and minimum number of users in laboratory?
- f. For what purposes you want the WLAN network to be used for the most?
- g. What is the main problem you faced due to previous network?

2.2. Wireless Site Survey Consideration

After analyzing the case studies, visiting the installation site and conducting the interview with the staffs and as an individual network consultant I am able to generate a wireless site survey report to outline the significant consideration that must be highlighted.

2.2.1. WLAN Site Survey

Generally, there are 4 types of site survey methodology such as:

- i. Passive Site Survey
- ii. Active Site Survey
- iii. Predictive Site Survey
- iv. Spectrum Site Survey

Among these passive and spectrum is suitable for this project.

i. Passive Site Survey

This site survey is about visiting the site where WLAN is going to install to measure the wireless signals from the sender to receiver with the help of a specialized software. It is mainly about the measurement of signal which help further during the installation. This site survey ends with the generation of heat maps, coverage area including the area where the signal can receive very low in a documentation (Peeters, 2018).

ii. Spectrum Site Survey

This site survey helps to identify the Radio Frequency signals within the site of installation. The network consultant will implement this site survey along with passive site survey to identify both Radio Frequency and wireless signal around the area.

2.2.2. Coverage area and capacity

Various factors are needed to consider where the WLAN network is going install. Coverage area is a certain area where the user can connect to the WLAN network and capacity is the ability which a network can handle or can provide service to the users. During the site survey the main thing is to collect the information about the size of the site in square feet which helps to generate a floor plan and to generate heat map.

In this case following answer should be asked during the site survey related to coverage area and capacity:

- a. Do you want to provide access to the public?
- b. What is the coverage area of the site?
- c. Can you provide the map, blueprint of the building?
- d. What range of speed is enough for your laboratory?

2.2.2.1. Size of the Area

The laboratory is in single floor of three storey building having an estimated size of 400 square feet and having 3 rooms excluding reception area, washrooms, and waiting area. As the size of the laboratory is not so much bigger but it surrounded by buildings and located in crowded area. Hence, we should router and access point by which constant and high-speed wireless network can be provided.

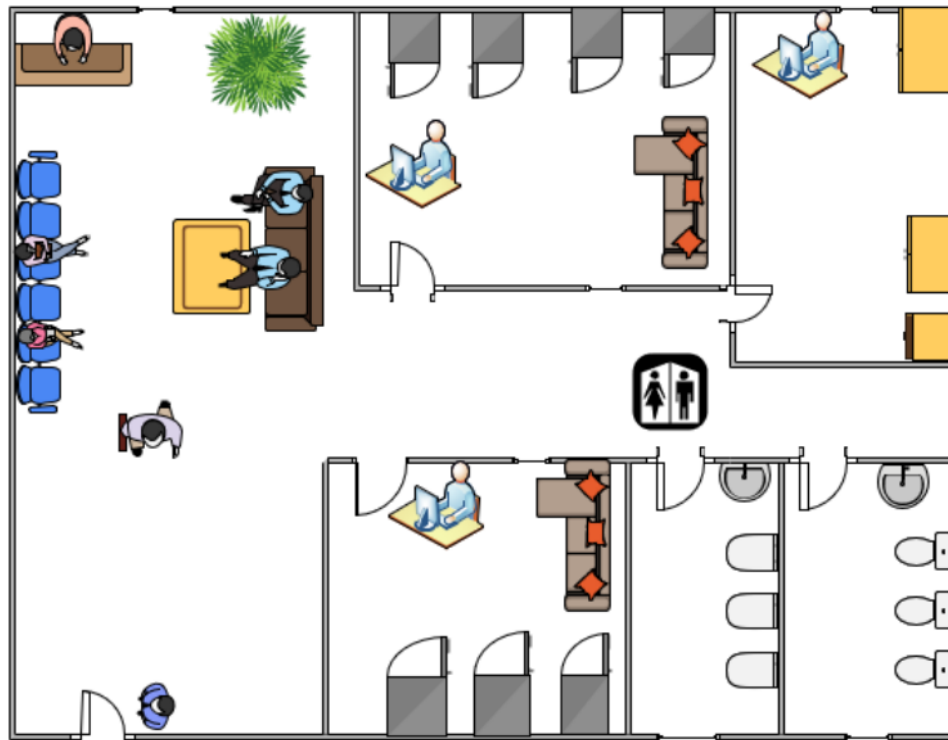


Fig: floor plan of United Reference Laboratory

2.2.2.2. Number of users

Radio Frequency wave is mostly affected by number of users. If there are a greater number of users connected then the low speed can be obtained from the WALN network. This is because

there are various powerful applications which create overload on the access point results in slow performance. So, using preliminary investigation the network consultant should be able to identify the maximum and minimum number of users in order to maintain the constant speed of the network in case of maximum and minimum number of users.

Users	Available
Head Doctor	1
Assistant Doctor	2
Co-workers	3
Nurses	2
Receptionist	1
Patients	5
Guard	1
Total	15

Good network speed is required to the head doctor and assistant doctors during their research. As the research can be performed to late night the network speed should be constant 24 hours. After them nurses need fair network connectivity in order to get information about the researches to help the doctors and assistant. Less priority is given to patient and guards where some patients need not to use available network. There are 11 users in maximum so the network consultant should deploy the WLAN network according to the priority explained above.

2.2.2.3. Types of Application

There is no any application that uses heavy bandwidth. As there is already mentioned in the project scenario that the WLAN network will be used for internet which includes browsers like chrome, Mozilla Firefox including others mobile's web browsers and software like spreadsheet which only requires constant connection as it contains all the information of patient and tasks completed by the doctors/nurses.

2.2.2.4. Obstacles

Main obstacle for the wireless signal is the concrete wall as shown in the floor plan of the lab. The strength of the signal decreases when it passes through the wall which can create an issue for the

signal coverage of the existing laboratory. As we measured the thickness of the concrete wall it was found to be 15 centimeters in approximate. The laboratory also consists of doors as a partition and windows that can also acts an obstacle for the wireless signal. Furnitures and other objects inside the laboratory can also affect the wireless signal and its strength.

2.2.2.5. Propagation

As there are 4 computers i.e., for head doctor, assistant doctor, nurses and receptionist excluding smartphones. Also, there are smartphones of the patients and other staffs of the clinic can be connected in order to access the internet. So, we can assume that there are 15 possible users in the laboratory. Speed of the WLAN network should be provided in such a way that it would not affect the tasks of the staffs when patients use the available network for internet usage.

2.2.2.6. WLAN Hardware and Output Power

While considering the coverage and capacity of WLAN we should need to consider the hardware and output power of devices which includes factors like output power signal, gain of antenna and polarization. Coverage is positively get affected by high gain of antenna and negatively affected by low gain. Similarly, polarization of antenna which means the position of antenna (horizontal or vertical) and output power of router and signal also affect the coverage area. According to the site survey

WLAN hardware and output power	Findings
Output power	Automatically steers to provide strongest signal between 2.4 GHz and 5 GHz
Gain of antenna	3 dB
Polarization	Vertical

2.2.3. Radio frequency range and speed

There are three factors that determines how far and fast a Radio frequency signal can travel which are line of sight, interference and environment RF behavior.

2.2.3.1. Line of sight

For the radio frequency communication between devices in a wireless network requires line of sight. Generally, there are two types of line of sight: Visual line of sight and RF line of sight. Visual line of sight is the ability of transmitter and receiver to see each other (Pindoria,2018). Similarly, RF line of sight between a transmitter and receiver is affected only when if the RF transmission is blocked by 40% or more and the cause of blockage can be a tree, building etc.

In case of United Reference Laboratory, all the wireless are located in test room and there are only walls between PCs and wireless devices inside the laboratory by which we can say that there is no any visual line of sight between the transmitter and all the available receiver. The RF range is within the range between 2.4GHz and 5GHz so, there is still strong connection.

Line of Sight	In laboratory
Visual line of sight	No
RF line of sight	Yes

2.2.3.2. Interference

Radio frequency interference occurs when a receiver found two signals of same frequency (Geier,2021). Interference occurs on three sources, Bluetooth, bright sunlight except 2.4GHz and 5 GHz, walls/doors.

In laboratory, there may be cordless phones, Bluetooth devices, and Wi-Fi around them which can cause RF interference. Similarly, metal/wooden furniture like sofa, receptionist desk, working table etc. medical devices and 15 cm wall also cause interference.

Devices	In laboratory
Cordless phones	Yes
Bluetooth devices	Yes
Microwave	Yes
Other Medical devices	Yes

2.2.3.3. Environment: RF Behavior

Radio frequency behavior is a result of environmental conditions which includes reflection, refraction, diffraction, scattering and absorption (Extreme Marking Team,2021).

a. Reflection:

Reflection occurs when a signal bounce from an obstacle. It can occur due to hard surfaces like walls, desks and others which decreases the throughput and poor signal of network (Loannidis,2017). In laboratory, furniture are normal types made up of wooden and metals and the density of wall is also normal. So, the wireless signal will not be affected inside the laboratory.

b. Refraction:

Refraction occurs when the RF signal/wave propagates through the medium of different density which results in the change of speed or loss of signal (Tigelis,2017). Glass is the main material which can cause refraction and there is different glass equipment inside the laboratory like glass partition, glass tables which can cause diffraction. So, we can say that the radio frequency signal somehow gets affected by refraction inside the laboratory.

c. Scattering:

Scattering occurs when the RF signal/wave strikes the rough surfaces and RF signal reflects in several directions (Hizandis,2018). Scattering affects the RF signal in the form of loss of signal. In laboratory there is no any rough surfaces all the walls and furniture are smooth so scattering will not affect the wireless signal.

d. Absorption:

Absorption occurs when the RF signal is absorbed by any kind of materials and results in weakness of the signal. For absorption human body containing more than half of water absorbs the RF signals. There is total 10 staffs in laboratory and maximum 5 patients who visit in laboratory in a day. Among them, head doctor visit laboratory only on special cases, among 2 only 1 Assistant doctor visit the laboratory in a day, 3 co-workers visit in a day, 2 nurses and 1 guard visit the laboratory whole day and patients are appointed to visit the laboratory in the morning before meal. So, altogether 7 people excluding patients are available in the laboratory whole day so, the absorption is normal and it will not affect the wireless signal.

2.2.4. Site Survey Conclusion

In case of United Reference Laboratory, it is far better to use a wireless local area network than the LAN network to connect all the devices inside the laboratory and accessing internet for their working purpose and work efficiently.

Due to various obstacles which can cause slow speed or loss in wireless signal we need to use an access point inside the laboratory including router to connect all the devices. As there are 4 personal computers inside the laboratory it requires central devices like router and switch. In this way we can create a Wireless Local Area Network for the laboratory.

3. WLAN Deployment Diagram

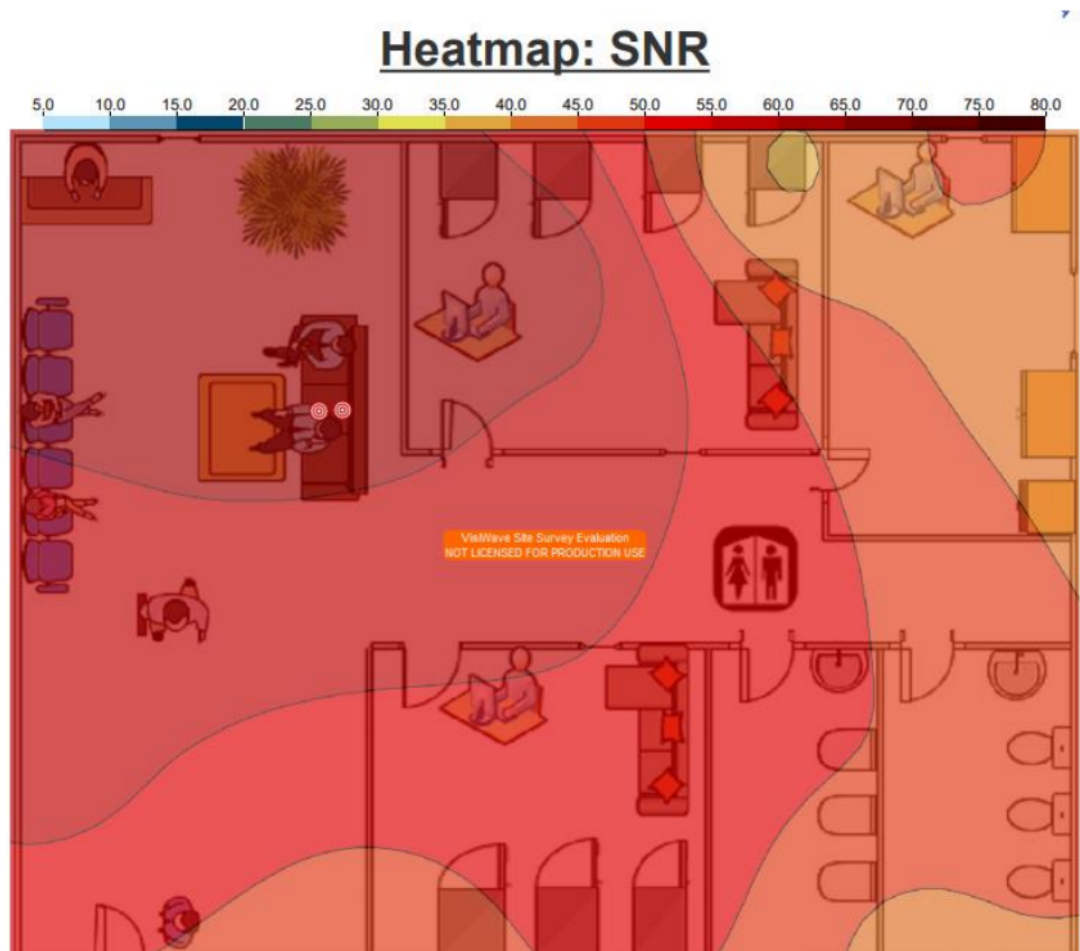


Fig: Heat map (SNR)

From the above figure of heat map which is generated using a software called “Visi wave site survey” we can find the best place for the placement of router and access point so, that the constant and faster speed can be provided. We can see that the signal to noise ratio in the test room is very low where we want WLAN to be faster because all the tasks related to the laboratory are performed inside the test room. So, as a network consultant I would like to suggest to place the access point inside the test room and router as shown in the figure below:

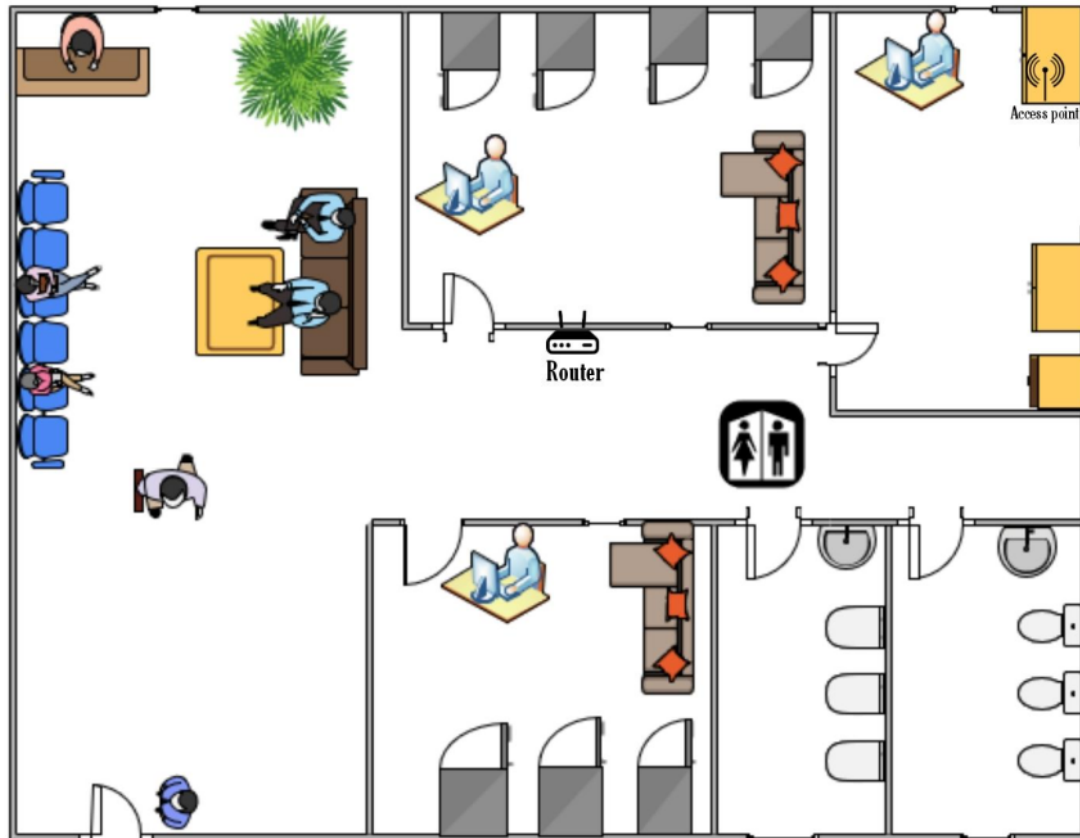


Fig: Placement of router and access point



Fig: Data Rate map

4. Hardware Requirements

As we all know majority of internet service provider company provides routers at free of cost during the first installation which provides only basic functionalities. So, following are hardware components which we choose as a network consultant to provide good service.

4.1. Router

We can find various routers in the market which are categorized according to the required features. According to the survey we know the requirement of the laboratory which helps us to choose the suitable router. Following are some best routers according to the features they support:

- a. Overall: Synology RT2600AC
- b. Speed: Netgear Nighthawk X10
- c. Coverage: Netgear Orbi Pro AC3000
- d. Security: Asus RT-AX88U

For small/home office as a network consultant I would like to recommend Synology RT2600ac which is the best in overall like value, speed, for streaming, coverage, security and many exciting features. RT2600ac is a powerful wireless router which is designed to understand, control and secure the network suitable for homes and small offices (Hyde, 2020). The coverage is now easily expandable using Synology RT2600ac with mesh Wi-Fi technology.



Fig 1: Synology RT2600ac Router

Additional Specification

CPU	1.7Ghz Dual Core
AC2600, Wave 2	With MU-MIMO and Beamforming

Antenna type	4T4R Omnidirectional high-gain dipole (2.4GHz/ 5 GHz)
Memory	DDR3 512MB
Wireless Security	WEP, WPA/WPA2-Personal and Enterprise

4.2. Cabling

As the WLAN infrastructure is to be established for small/home office and according to the WLAN site survey the network established in the laboratory should be work 24 hours with constant speed and due to only maximum 11 member can be available at a time we should choose the cable according to the speed which the router can provide. Maximum 1000 Mbps/ 1 Gbps speed with 250 MHz bandwidth can be enough for both internet and information storage software. So, as network consultant I have to select the suitable cable according to the speed required. From the below table we can easily choose the suitable cable for forensic lab.

Category	Maximum Transmission	Maximum Bandwidth
Cat 5 (unshielded)	10/100 Mbps within 100m	100 MHz
Cat 5e (unshielded)	1 Gbps within 100m	100 MHz
Cat 6 (shielded/unshielded)	1 Gbps within 100m	250 MHz
Cat 6a (shielded)	10 Gbps within 100m	500 MHz

According to the speed and maximum bandwidth I think cat 6 is suitable as the above requirements. As cat 6 provides greater bandwidth and high data rate than cat 5 and cat 5e. Its costs have also reduced. Additional fact of cat 6 cable is that it can also provide higher data rate of 10Gbps at the range of 37-55 meters (Warren and Brown,2017). In case of heavy workload in the laboratory it can provide good speed as the coverage area of the laboratory is not so bigger.

Some additional features of Cat 6 cable

- a. Affordable
- b. Less interference

- c. 2.5 and 5G Ethernet within 55 meters
- d. Supports Gigabit Ethernet

4.3. Access Point

As the main research laboratory room is at the corner of the floor there are many obstacles like door, walls, glass furniture and number of users inside the test room it may reduce the network speed and can create problem for the receptionist who store data about the patients and their appointment. So, to prevent such problem I suggest to use access point in the reception area as the router is placed in the test room in order to maintain the constant network speed.

We can find various access point in the market among all Meraki Go's is the best access point suitable for small/home office. It is indoor Wi-fi cloud-based approach which allows to increase the production and customer involvement with a minimum of time and resources.

Some of the features if Meraki Go are:

- i. It blocks unwanted websites.
- ii. It set the limit of usage.
- iii. It helps to prioritize bandwidth.
- iv. It is specially used for indoor purposes.
- v. It consists of single port and internal antennas.



Fig: Meraki Go's Access Point

5. Software Requirements

5.1. Firewall

Generally, a firewall is a security layer that exist between home network and the internet. The features of firewall are merged with routers as it is the main connection between internet and home network. It mainly preserves the privacy of home network, detects the gain of access to operating system and blocks unwanted traffic. Only we need is to enable the firewall of router so it scans all the communication data between internet and home network to protect the network security (Grace,2019).

5.2. Antivirus Software

Whenever the hackers get the access of the original login screen and can change the router settings, the viruses like Switcher Trojan and VPNFilter can enter to the router. The embedded firmware which controls the router sometimes get modified by the viruses. With the use of anti-virus software, we don't need to throw that infected router or repair it (Dube, 2020).

For avoiding these problems, we have top 5 antivirus software that ensure the Wi-Fi security

- a. McAfee
- b. Bitdefender
- c. AVG
- d. Avast
- e. Intego

Among all the above antivirus software I would like to prefer Bitdefender which costs \$32 with internal security for 3 devices per year. It also come with 3 years of unlimited security access. Multiple security features are found to be combined in single software (Sklar,2021). As most of the devices in the forensic lab are windows and android/IOS it provides the facility of anti-theft and system optimization. Similarly, for android and IOS devices it provides premium protection and limited protection. There are many features which Bitdefender can provides which are listed below:

- a. Threat protection from network
- b. Attack protection form web
- c. Anti-phishing protection

- d. Threat defense protection in advance
- e. Provides privacy firewall

5.3. Router Manager

We also need router manager while installation in order to detect who is using the installed wireless network. This will help the router to be safe from unauthorized access. As there are many routers manager available in the market but as a network consultant, I would prefer PRTG router monitor which is all in one router monitor software. Using PRTG router monitor it will be easy to detect the devices which are consuming more bandwidth and where bottlenecks occur, network traffic and also provides message regarding error in router. It monitors router using SNMP. Sniffer and many more (Alpher, 2019).

PRTG router manager provides broad array of features which allows you to easily monitor the router 24/7 and also calculate the network usage by the connected devices. It enables your computer fans, temperatures, power supply to the devices and memory of the router to be kept under your eye.

If there is anything seems to be wrong within the router or network traffic PRTG will automatically notify you. It allows you to prevent from paralyzing the bandwidth bottlenecks.

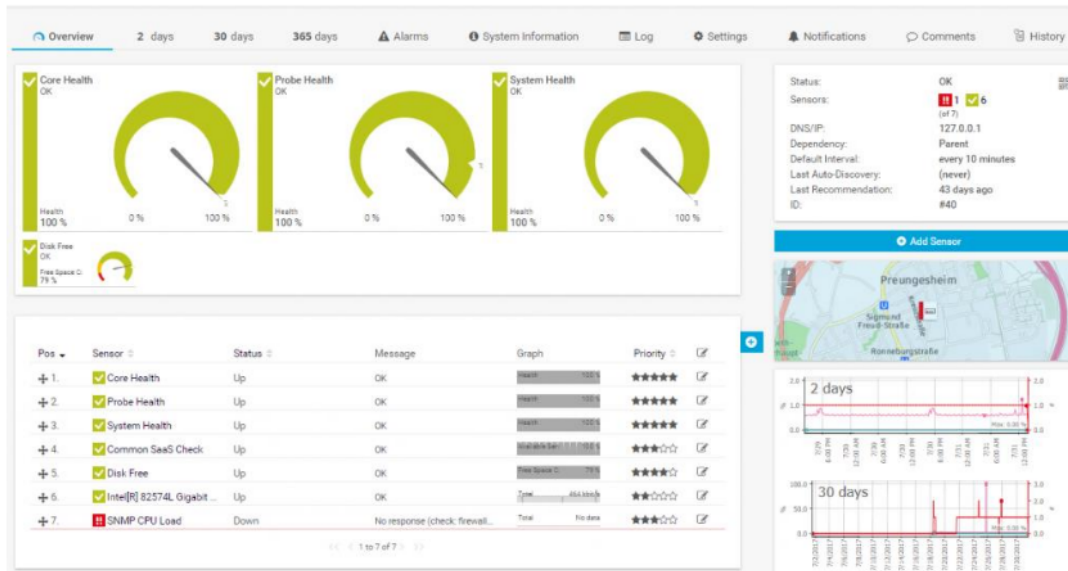


Fig: PRTG router manager homepage

6. Conclusion

In conclusion, being a network consultant after researching all the requirement suitable after reviewing the site survey report I have provided a network design proposal to the United Reference Laboratory which will provide them a best and wireless network of constant/faster speed. Similarly, we created various heat maps for different device location to find best location for the placement of router and access point to provide a WLAN network of constant and high speed to all the staff and patients who visit the laboratory. Similarly, heat map also to show how each placement can affect the connectivity inside the laboratory. In this way using heat map we can choose best location for the placement of devices.

7. References

1. B. (2017, September 8). *Meraki Go GR10 | Access point | Indoor, Dual-band, 802.11ac Wave 2, 2x2:2 MU-MIMO*. Batna24. <https://www.batna24.com/en/p/cisco-meraki-go-gr10-access-point-rmmkh>
2. *Bitdefender Internet Security - Internet Security Software*. (2011, January 2). Bitdefender. <https://www.bitdefender.com/solutions/internet-security.html>
3. ComputerNetworkingNotes. (2019, March 17). *Types of Firewalls Explained with Functions and Features*. <https://www.computernetworkingnotes.com/ccna-study-guide/types-of-firewall-explained-with-functions-and-features.html>
4. Synology Inc. (2019, March 22). *Synology RT2600ac | AC2600 high-speed Wi-Fi router | Parental controls & security | Synology Incorporated*. <https://www.synology.com/en-global/products/RT2600ac>.
5. *The 8 Best Small Business Routers of 2021*. (2020, June 11). The Balance Small Business. <https://www.thebalancesmb.com/best-small-business-routers-4171956>

ORIGINALITY REPORT

4%

SIMILARITY INDEX

2%

INTERNET SOURCES

0%

PUBLICATIONS

3%

STUDENT PAPERS

PRIMARY SOURCES

1

Submitted to Asia Pacific University College of Technology and Innovation (UCTI)

Student Paper

2%

2

www.newegg.com

Internet Source

<1%

3

www.scipedia.com

Internet Source

<1%

4

Submitted to Monash University

Student Paper

<1%

5

www.synology.com

Internet Source

<1%

6

www.ghacks.net

Internet Source

<1%

Exclude quotes Off

Exclude matches Off

Exclude bibliography On