

WIRELESS COMMUNICATIONS

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ABSTRACT

In this paper, the author discusses the concerns of using various wireless communications and how to use them safely. The author also discusses the future of the wireless industry, wireless communication security, protection methods, and techniques that could help organizations establish a secure wireless connection with their employees. The author also discusses other essential factors to learn and note when manufacturing, selling, or using wireless networks and wireless communication systems.

KEYWORDS

Wireless, Network, Security, Hackers, VPN, IP address.

1. INTRODUCTION

Many individuals and organizations widely use wireless communications. They allow many industries to develop new manufacturing ideas and provide various wireless communication methods. The technology that we have today supports a wide range and variety of wireless devices. Previously, almost all the devices humans used were wired devices, which helped the users use the electricity to use a device. Wireless devices were introduced to make the user's usage easy. In today's world, we want everything to be wireless and easy. The technology has advanced so much that we even have self-driving cars, a faster network, high-resolution camera lenses, wireless charging, and voice command devices. Wireless communication has made our lives easy.

We even want to use wireless technology to charge our mobiles. We use wireless keyboards, mouse, printers, remotes, gaming consoles, and many other wireless devices. Wi-Fi is another wireless connectivity for the internet [1].

Wireless devices help humans multi-task. For example, we can play a game on the television and use a voice command to play music on a speaker. Even when wireless technology makes our lives easy, it has many drawbacks and security concerns. Wireless devices are more prone to be attacked or hacked by a hacker as these devices support a connection to both authorized and unauthorized Wi-Fi networks. Many suppliers provide open Wi-Fi at coffee shops and restaurants, letting users connect while away from their home network. The hackers could easily access these open networks and, in turn, become a threat to the connected users as their data gets exposed within that network. We need to be careful when connecting to an unrecognized network as sometimes these networks could be a trap for hackers to steal the data from the users who get connected to that network.

2. RESEARCH QUESTIONS

- Are there too many security concerns with wireless connections?
- Do wireless protection methods work to provide security?

3. WIRELESS COMMUNICATIONS SECURITY

Security can be an issue with almost everything being developed and used with wireless technology. Another issue could be the connectivity range. Security is the central issue still being longed for, even with extreme technological advancements. Humans were able to increase the internet speeds, provide a broader range for Bluetooth and Wi-Fi, and create robots using artificial intelligence and machine learning. However, security standards still need to be improved. Whenever we develop a new solution to provide security to data and devices, hackers tend to surpass our efforts by introducing a new technique to hack into our systems and steal our data.

The developers use encryption methods for wireless communication to secure the connection between the two devices, such as a wireless keyboard. The connection here gets established between the keyboard and the laptop or the other device we are trying to use for the wireless keyboard. Encryption is one method that the developers use to provide a secure connection between the parties so that an intruder cannot eavesdrop or illegally access the data [2].

Many wireless connections come with numerous security concerns. A wireless network could be more convenient, but hackers also use it as a hacking medium. Many organizations use cloud networks to store their information, which would help authorized users access the required data remotely. As the cloud is a virtual storage location, it can get exposed to many unauthorized users trying to gain network access. Organizations increasingly adapt to artificial intelligence (AI) and machine learning (ML). Robotics is an exciting and interactive platform. This can make the tasks easy for us, but like the wireless networks, even AI and ML have many limitations and security concerns. Even with advanced technologies like AI and ML, the primary security concern is the data fed to the automated devices [3].

A robot that functions as needed is programmed in a particular way to achieve the desired results. A large amount of data gets fed for the robot to listen, process the information, and respond to the user's command as needed. This data could be at risk as the robot is still a machine working on the data and internet or a medium prone to hacks. AI is trying to achieve the required security through its processes. Still, no machine or network can achieve complete security, even with the daily introduction of many new technologies, software, and hacking methods. Security is the primary concern with the Internet of Things (IoT). No matter how advanced the methodologies are, hackers tend to introduce a technique that questions the set security standards [4].



Figure 1. Wireless Communication

4. WIRELESS PROTECTION METHODS

4.1. Encryption

The data and the connection must be encrypted for safety when establishing a wireless connection. This is one method the organizations use when developing wireless devices. The established connection must be secure, or the customers will not prefer to purchase or use the wireless devices or connections. When transferring data over a wireless medium, it is safe to encrypt it as it could still be protected even if an unauthorized user tries to access the information by hacking it. Encryption is a standard method many organizations use to achieve a secure and safe data transfer. As the hackers target wireless and cloud mediums to gain access to the data, it is essential to practice safety while handling the data [5].

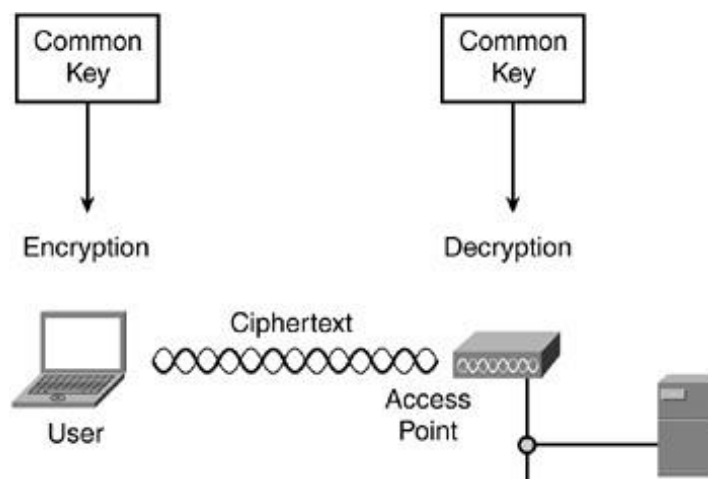


Figure 2. Encryption

4.2. VPN (Virtual Private Network)

Wireless usage has increased since the COVID-19 pandemic. Many organizations have adapted to the work-from-home culture for the safety of their customers. When working from home, the employee needs a VPN (Virtual Private Network) to connect remotely to the central server to access the data and stay connected with the organization. When this connection is enabled, the IP address of the employees' system gets masked, making it hard for the hacker to trace. This is another reason many organizations continue to use remote work. Security could be a concern as the user gets connected remotely to the organization's database, where large amounts of organizational data get stored. The hackers could target the remote workers as they try to connect to their organization over an unsecured internet connection. The data and the established connection are safe if the user uses a secured connection. [6].

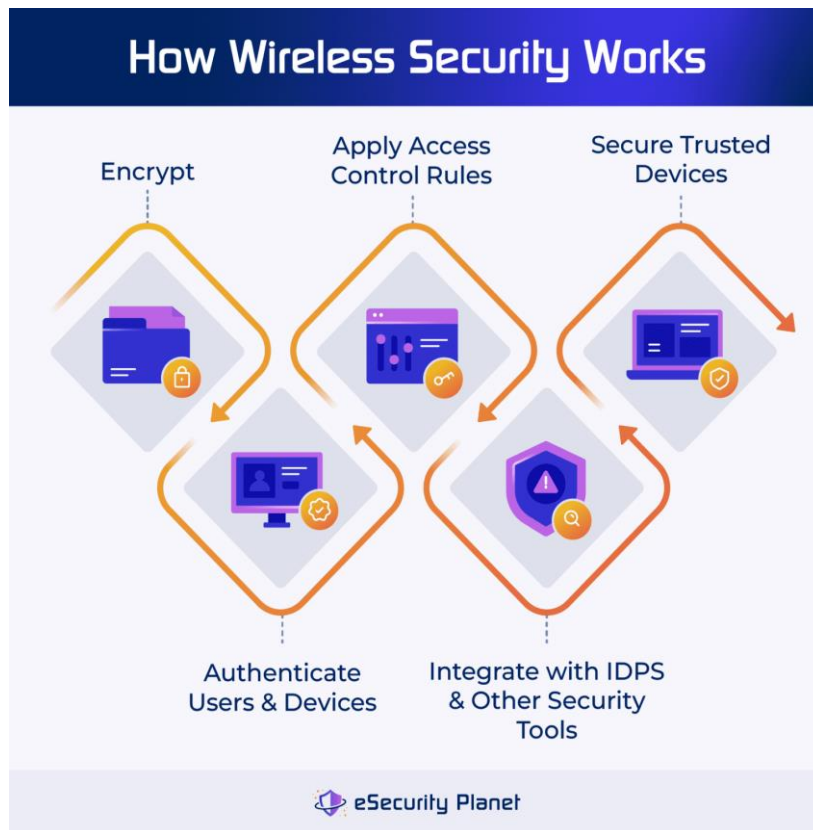


Figure 3. How Wireless Security Works

4.3. Authentication

When setting up wireless communication, we always see a notification or an authentication message that tells us that the connection is secure and that it is being established only between the two devices or parties we are trying to connect. Let's say we are trying to connect a wireless headphone to a laptop. Once the connection gets established, we can use the headphones without issues. If we try to connect another device to the same wireless headphone, we would have to disconnect it from the laptop to connect it to another device. This is one way the companies tell their users that their connection is protected [7].

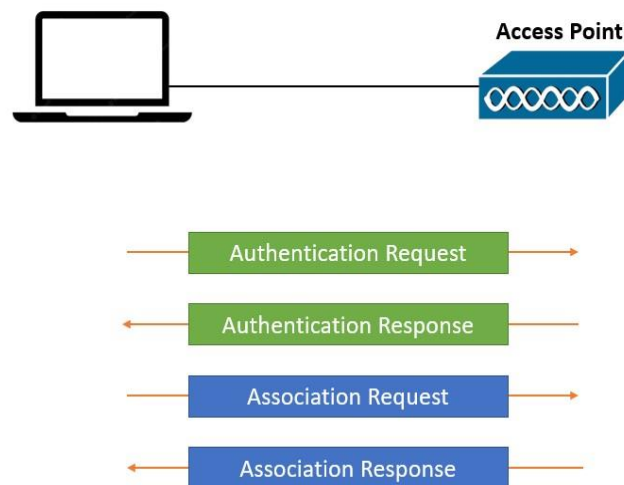


Figure 4. Authentication

5. CONCLUSION

Connections like Wi-Fi, hotspot, and Bluetooth might come with certain limitations. Sometimes, these connections could get hacked when connected to an unsecured internet. For example, when we connect our device to a home network, it is secure as we set a password to our network, and only we would know the password. But when we connect our device to an open internet connection at a coffee shop, the connection could be more robust with solid firewalls. We must be careful while establishing a connection using our devices to protect our data from getting stolen. Every innovation has its advantages and disadvantages. We must learn about it before using it. Wireless networks have drawbacks, but many individuals and organizations widely use them for many purposes. By following specific measures, we can protect our data using wireless connections and mediums from getting stolen or hacked.

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The author earned her PhD in Information Technology (Information Security Emphasis) from the University of the Cumberland in 2024. The author is continuing her research within the security emphasis and is also expanding her research into artificial intelligence and machine learning to develop security measures using the latest technology standards.

