Analysis of Wireless Networks: Successful and Failure Existing Technique

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One special feature of wireless networks is their capacity to keep people in contact even when they switch locations. The adaptability and agility needed for wireless communications are provided. The fields of business, education, defense, home-based and industrial applications, and the military environment have all found use for wireless and mobile communications. The world has changed significantly as a result of wireless networks since they have made it easier, more reliable, and more efficient to send information abroad or behind enemy lines. An essential productivity tool for today's mobile workforce is wireless networking. With wireless networking, we may practically access corporate and other information resources at any time and from any location. In recent times, wireless networks have become more commonplace in several fields, such as satellite broadcasting, mobile analog, and digital cellular telephones. Supporting a good quality of service (QoS) in this environment for the delivery of voice, video, and data has therefore become one of the major challenges of the twenty-first century. In this research article, we provide an overview of wireless networks, their classification, and quality of service (QOS) parameters such as bandwidth, delay, delay variation (jitter), throughput, and energy. Lastly, we provide security information regarding various parameters for end-to-end communication over wireless networks.

Keywords: Wireless network, Survey, QoS, Data Transmission, Video Transmission, performance, security, bandwidth.

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1. Introduction

By sending and receiving data over the air via wireless media, such as radio frequency technology, a wireless network is a flexible data communications system that lowers the need for physical connections. Thanks to the wireless communication revolution, data networking is going through a significant transition. Thanks to recent developments in wireless networks and technology, the great majority of wireless devices in use today are able to connect with ease. For the millions of wireless devices to have wireless connectivity, the greatest possible utilization of spectrum resources is also necessary [1]. Without requiring any physical connections, wireless networks transfer information between locations using electromagnetic waves. Radio waves are frequently called radio carriers since they only send energy to a distant receiver. The data being transferred is superimposed over the radio wave to guarantee accurate extraction at the receiving end. After data is overlaid (modulated) over the radio carrier, the radio signal occupies many frequencies due to the modulating information's frequency or bit rate adding to the carrier. Numerous radio carriers can coexist in the same space without interfering with one another if the radio waves are sent at different radio frequencies. The three elements that comprise a wireless network are radio signals, data formats, and network architecture. All three of these elements need to be described when building a new network since they are unrelated to each other. The data format affects several of the higher levels of the OSI reference model, whereas the radio signal operates at the physical layer. The network structure includes base stations and wireless network interface adapters that send and receive radio signals. The network interface adapters in every computer and base station in a wireless network transform digital data into radio signals, which are then sent to other connected devices. Additionally, they transform incoming radio signals from other network components back to digital data after receiving them and converting them back to radio signals. Different data formats, network architectures, and radio signals are used by each broadband wireless data service [2].

Wireless networks are more productive, convenient, and cost-effective than traditional wired networks for the reasons listed below:

- Mobility: Provide real-time data access and seamless network mobility for mobile consumers. These alternatives for service and productivity are not possible with wired networks.
- Installation simplicity: Setting up a wireless system is rapid and simple, and it does away with the need to run wires through ceilings and walls.
- Network reach: it is possible to add sites that are not now part of the network.
- Greater Flexibility: Wireless networks are easier to reconfigure and more flexible.
- cheaper lifespan costs and overall installation costs: Although wireless network gear initially may cost more than wired network hardware, in dynamic contexts, these costs may be significantly lower.
- Scalability: Different topologies for wireless systems may be customized to meet the requirements of different installations and applications. Network configurations may be readily altered for networks ranging from small-scale peer-to-peer networks ideal for a limited number of users to extensive infrastructure networks that facilitate roaming over a vast region.

Wireless networking allows you to connect several computers in your home without the need for a physical cable. Providing internet and email connectivity to every computer is a great benefit. Requirements include a cable or DSL modem to receive and send data to the internet, wireless cards for each computer, an internet service provider such as your phone or cable company, and a single wireless router. Wireless wide-area networks are wireless networks that often span large outside regions. These networks can serve as a means of connecting business branch offices or as a public internet access system. They usually run on a 2.4 GHz frequency. Another architecture in which every access point doubles as a relay is the mesh system. When combined with renewable energy sources like wind turbines or photovoltaic solar panels, they may operate on their own. Various frequencies are utilized for information transmission over the air using wireless protocols (802.11 standards). The most commonly utilized frequency for wireless data consumption is 2.4 GHz [2]. Wireless networks are expected to enable multimedia services. Wireless communication technology offers a multitude of services, such as the transmission of audio, video, text, graphics, animation, and images. The capacity of wireless networks is greatly demanded by these services. The customer wants to send and receive a variety of data formats, such as audio and video. Thus, the bandwidth requirements of different users differ significantly from one another. Furthermore, a minimum level of guaranteed performance is required for the quality of service (QoS) components of bit error rate, latency, jitter, and bandwidth. When the percentage of total bandwidth in a cell that is used by user bandwidth demand rises, there is a greater chance of blocking in cellular networks. Making sure that all users receive the QoS they expect given the constrained quantity of RF spectrum that is available is an intriguing and difficult resource management subject.Modern wireless applications heavily rely on real-time communication since data is isochronous. They also require high quality, fast transmission rates, and high interaction levels [3].

1.1 Classification of Wireless Networks

1.1.1 Introduction

The most common classification scheme for wireless networks is comprised of five unique or separate groups. The main criteria used in this classification are the application region and signal range (Figure 1). The first group, referred to as WBAN, includes wireless networks used to link different devices on the surface of the body to one another. These networks have a maximum signal range of two meters. The second group, referred to as WPAN, includes wireless networks with a minimum signal range of 10 meters that are used to connect different devices to one another. The third group complies with the wireless network standard, which is intended to cover a maximum of one building or room. This group, called WLAN, usually has a signal range of 30 meters indoors and 100–200 meters outside. Wireless fidelity (Wi-Fi or IEEE 802.11) is a common term used to describe wireless technology. With a signal range of around 5 to 20 kilometers, the WMAN, the fourth class of wireless network, allows users to connect to the Internet. Many times, this protocol is referred to as IEEE 802.16-2001, or worldwide interoperability for microwave access (WiMAX). The last group is the WWAN.WWAN (GSM and CDMA-based networks) provide wireless connections over a much larger region than the group stated above by using the network infrastructure of mobile operators [4].

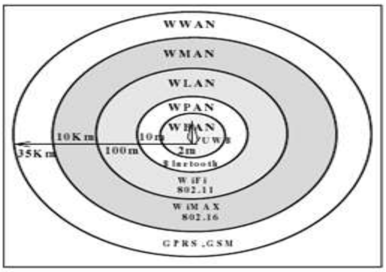

Figure 1: Classification of wireless networks with their signal range [4].

Figure 1: Classification of wireless networks with their signal range.

1.1.2 Wireless Body Area Networks (WBAN)

WBAN may be thought of as a specific type of sensor network with certain requirements. A wristband bandana alarm (WBAN) is a collection of tiny, wearable, networked sensors that may be inserted into the body or worn on it to monitor vital signs. These devices use wireless communication to send data from the human body to a home base station, from which it may be promptly sent to a clinic or hospital.Among the WBAN's technology criteria are:

1) Employing a wideband signaling system.

2) lower than the 6 GHz frequency range.
3) In order to address significant route loss throughout the human anatomy, allow for diverse multi-hop connections.

Learn how WBAN may be utilized when long-term patient data tracking is necessary to monitor patients with chronic conditions including diabetes, asthma, and heart attacks. A patient with diabetes could be made "doctor-free" and essentially healthy by having a WBAN placed on him or her that would automatically inject insulin through a pump as soon as the patient's insulin level drops, or it could be used to notify the hospital of changes in the patient's signs, perhaps even before he has a heart attack [4].

1.1.3 Wireless Personal Area Networks (WPAN)

WPAN is enabled by a number of network technologies, including Bluetooth, UWB, ZigBee, and infrared data association (Irda). The IrDA outlines the technical criteria for a standard short-range infrared light communication protocol for widespread usage in wireless personal area networks. IEEE 802.15.1, which is another name for Bluetooth, is an industrial WPAN specification. Devices such as PDAs, mobile phones, laptops, PCs, printers, digital cameras, and gaming consoles may connect and exchange data via Bluetooth, which provides a secure, unlicensed short-range radio frequency. Bluetooth is a radio standard and communication protocol designed primarily for low power consumption, with a limited range (depending on power class: 1, 10, and 100 m). Each gadget has low-cost transceiver microchips that support it. UWB is a radio technique that can be used for very low-energy short-range high-bandwidth communications by using a large portion of the radio spectrum. Based on the IEEE 802.15.4 standard for WPANs, ZigBee is the brand name for a collection of high-level communication protocols that employ small, low-power digital radios. Headphones that connect to cell phones via short-range radio are one example of these protocols [4].

1.1.4 Wireless Local Area Networks (WLAN)

A WLAN, or wireless local area network, is the connection of two or more computers in a structure or small campus without the need for cables. WLAN uses radio wave-based spread spectrum or orthogonal frequency-division multiplexing (OFDM) modulation technology to enable communication between devices in a limited area. Now, users may roam freely across a wide service area and stay connected to the network. Wi-Fi is the WLAN technology that is most often utilized. Working group 11 of the IEEE LAN/MAN Standards Committee (IEEEE 802) produced a set of WLAN standards known as the IEEE 802.11, or WiFi standard [4].

Wireless LANs provide high-speed data delivery inside a restricted region, such as a campus or small building, while users move about. Often, stationary or slowly moving wireless devices connect to these LANs. All wireless LAN technologies in the US operate on unlicensed frequency bands. The primary unlicensed bands include the Unlicensed National Information Infrastructure (U-NII) band at 5 GHz and the ISM bands at 900 MHz, 2.4 GHz, and 5.8 GHz. As secondary users operating in the ISM bands, unlicensed users have to deal with interference from prime users (5).

1.1.5 Wireless Metropolitan Area Networks (WMAN)

The name "WMAN" refers to the wireless metropolitan area network standard (often known as WiMAX in the commercial sense) of the IEEE 802.16 Working Group on Broadband Wireless Access Standards, which defines broadband Internet access via fixed or mobile devices. This is a great alternative to fixed-line networks since it is affordable and simple to set up. The WiMAX Forum established WiMAX, a global microwave access interoperability standard, to support WMAN, the official name for the IEEE 802.16 standard, both interoperability-wise and in terms of compliance. The Forum states that WiMAX is a "standards-based technology that enables the delivery of last-mile wireless broadband connectivity as a substitute for cable and digital subscriber line (DSL)." For a variety of reasons, most WiMAX networks will likely claim an average cell range of 4-5 miles despite obstacles like buildings and trees. Applications utilizing line-of-sight (LOS) technology are projected to have service ranges up to 10 miles (16 km). Even though it is frequently used by several individuals and organizations, a WMAN can be owned and operated by a single entity [4].

1.1.6 Wireless Wide Area Networks (WPANs)

A wide-area network (WWAN) is a computer network that has a large geographic reach. The largest and most well-known example of a WWAN is the Internet. In order to facilitate communication between users and computers in different places, WLANs are connected via WWANs. For a single corporation, several private WWANs were established. Others that were developed by ISPs give companies LAN access to the Internet. WWANs allow mobile users to connect, particularly businesspeople who are always on the go. WWANs allow users to maintain access to work-related data and programs even while they are not in the office. WWAN connectivity requires wireless modems and a wireless network infrastructure, both of which are provided as free services by a wireless service provider. Radio waves are used in interactions between wireless networks and related wireless modems and portable devices. The modem sends out a signal via radio towers to a mobile switching center, which forwards it to the relevant public or private network link. Cellular network technologies like WiMAX, UMTS, GPRS, HSDPA, or 3G are used by a WWAN to transport data. In return for a monthly use fee, a wireless service provider makes these technologies available locally, nationally, or even worldwide [4]. Wide-area wireless data services provide high-mobility consumers with wireless data over a significant coverage area. In these systems, a particular geographic region is covered by base stations situated atop towers, rooftops, or mountains. The base stations have the option to connect to a backbone wired network or a multi-hop wireless ad hoc network. Early wide-area wireless data services had data rates as low as 10 kbps, but they later reached 20 kbps [5].

1.1.7 Satellite Networks

An object that orbits another object is called a satellite. The moon, for instance, is a satellite of both the Sun and the Earth. Rockets are used to drive man-made satellites, which are very specialized wireless receivers and transmitters, into Earth's orbit. At the moment, hundreds of satellites are in service. A satellite-based component called the transponder, which "reflects" the signal toward the receivers, and a ground-based component called the uplink comprise the transmitter in satellite communication systems, which is located in the sky rather than on the ground [4]. Commercial satellite systems constitute yet another crucial component of the infrastructure for wireless communications. The former is mainly suited for sending analog voice messages across long distances. For example, it's often used by journalists to provide breaking news from combat zones in real time. The technology is mostly utilized for alphanumeric messaging and fleet location tracking in transportation. There are several major obstacles to overcome in the delivery of voice and data services via geosynchronous satellites. Since communicating with these satellites demands a lot of power, handheld devices are frequently large and heavy. Additionally, there is a noticeable audible round-trip propagation delay in two-way speech communication. The highest data rate for geosynchronous satellites is less than 10 kbps. Voice and data communications were thought to function better with lower-orbit LEO satellites as a result of these considerations [5].

1.1.8 Broadband Wireless Access

Broadband wireless access enables high-speed wireless communication between several endpoints and a stationary access point. The original purpose of these systems was to provide interactive video services for home users. However, their primary use has shifted to high-speed data access (tens of megabits per second) to the Internet, the World Wide Web, and high-speed data networks for home and business usage. Two frequency bands were reserved in the US for these systems: one in the 28 GHz band for local distribution systems (also called local multipoint distribution systems, or LMDS) and one in the 2 GHz band for metropolitan distribution systems (multichannel multipoint distribution services, or MMDS).

Via LMDS service providers, new service providers can easily join the existing competitive market between wireless and wired internet access. Transmission ranges for the MMDS television and telecom delivery systems are 30 to 50 kilometers. MMDS may offer access to over 100 digital video TV channels, phone service, and new interactive services like the Internet. The present cable and satellite providers will be MMDS's primary rivals. Hiperaccess is a European standard that is similar to MMDS. WiMAX is a future wireless broadband technology based on IEEE 802.16. The fundamental 802.16

specification is a standard for broadband wireless access networks that use radio frequencies between 10 GHz and 66 GHz. Data speeds of around 40 Mbps will be available to fixed clients, while mobile users will be able to access 15 Mbps speeds across several kilometers. When WiMAX is available, a lot of laptop and PDA makers want to use it to meet the need for continuous Internet connection and remote email exchange [5].

1.2 Quality of Service (QOS) Parameters

1.2.1 Introduction Quality of Service (QOS)

Quality of service (QoS) is a need for expanding high-speed data networks. This is especially true when it comes to meeting real-time data consumers' constraints on data rate and packet latency. The network must follow certain quality of service (QoS) requirements when transferring a packet stream from source to destination. Special challenges arise in networks that use wireless communication because of this requirement. In actuality, a wireless channel's quality fluctuates greatly across users and wildly changes over time on both slow and fast time scales. Moreover, wireless bandwidth is usually a finite resource that needs to be utilized carefully. Providing the right quality of service (QoS) to as many people as possible requires finding efficient ways to provide QoS for real-time data (such as live audio and video streams) across wireless channels [6]. Reliable network performance has always been an essential component for a lot of network applications. However, with the increase in the amount of audio and video data carried via open, packet-switched networks, the capacity to guarantee quality of service (QoS) may be more important than ever in today's networks. Consequently, a great deal of work has gone into figuring out how to provide consistent network performance while simultaneously utilizing all of the resources that are available. Probably the most crucial prerequisite for audio and video transmission success is service guarantees. Many service providers have started to use packet-switched networks to provide video and phone services in recent years. The IP network offers extra capacity that may be utilized for a fraction of the cost of a dedicated, circuit-switched network, which is one reason these services were created. Another argument is that the form-free nature of a packet-switched network increases its adaptability and allows for the creation of new services like video on demand. A special issue for audio/video transmission (VBR) arises from the fact that different compression methods encode the streams at varying bit rates for maximum efficiency. For such streams, it is possible to guarantee throughput at the highest bit rates, but this is ineffective. Alternatively, a more advantageous Quality of Service (QoS) system would ensure throughput at the average bit rate and allow bursty traffic with the least amount of additional loss and delay [6].

1.2.2 Quality of Service (QOS) Parameters

1.2.2.1 Bandwidth

The ability of a wired or wireless network communications link to send the most data possible via a computer network or internet connection in a specific length of time, typically one second, is known as bandwidth. Data transfer rate is referred to as bandwidth, which is synonymous with capacity.Modern network lines offer higher capacity, which is often measured in millions of bits per second (megabits per second, or Mbps), or billions of bits per second, whereas bandwidth is conventionally stated in bits per second (bps), or gigabits per second, or Gbps).

How bandwidth works: The more bandwidth a data link has, the more data it can send and receive at the same time. The amount of water that can flow via a water pipe can be likened to bandwidth. More water can flow through a pipe at once, the larger the pipe is. The same idea governs how bandwidth functions.Therefore, the more data may travel through a communication link or pipe per second, the higher it's capacity. End users are responsible for paying for the bandwidth of their network connections. Therefore, the more bandwidth a link has, the more expensive it is. The performance of a network is influenced by a number of factors, including the connection's maximum capacity. Multiple network lines with various bandwidth capacities often make up an end-to-end network route. As a result, the connection with the lowest bandwidth is sometimes referred to as the bottleneck since it can reduce the total amount of data that can be sent through all of the connections in the path. Bandwidth on demand, also known as dynamic bandwidth allocation or burstable bandwidth, is an option that enables subscribers to increase the amount of available bandwidth at specific times or for specific purposes, in addition to dedicated communication links with the maximum amounts of bandwidth, which are typically sold at a set price by the month. A technology called bandwidth-on-demand can supply extra capacity to a communications network to handle spikes of data traffic that momentarily need more bandwidth. Wide area networks commonly employ dynamic bandwidth allocation supplied by service providers instead of over-provisioning the network with pricey dedicated lines to enhance capacity as needed for a certain event or at a specific time of day. A shared telecommunications network's capacity may be extended using this method, and customers only pay for the extra bandwidth they use. Many service providers provide burstable bandwidth because the network lines they give their clients have access to more bandwidth, yet clients only pay for what they really use. Because of the capability of the service provider's connection, a 100 Mbps link, for instance, could be able to burst up to a gigabit. It would be necessary to establish a second physical connection if a user desired more bandwidth than what was physically possible on that link [7].

1.2.2.2 Delay (Latency)

The duration from the moment the first bit is sent out from the source until the full message has arrived at the destination is known as latency or delay. Propagation time, transmission time, queue time, and processing delay are all parts of latency.
Propagation time, transmission time, queueing time, and processing delay all makeup latency.

The amount of time it takes for a bit to propagate from its source to its destination is measured as propagation time.
One may get the propagation time by dividing the distance by the propagation speed.

Distance/Propagation Speed = Propagation TimeTransmission Time: In data communications, a message is sent instead of simply a single bit. The propagation time may be used to determine how long it will take the first bit and the last bit to reach their destinations. The period between the first bit leaving the sender and the last bit reaching the recipient does exist, though. The first portion departs and arrives sooner, while the latter portion departs and arrives later. The amount of time needed to transmit a message depends on its size and the channel's bandwidth.

Bandwidth/Message Size = Transmission Time

Queuing Time: The third factor in delay is queuing time, which is the amount of time each intermediate or final device must hold the message before processing it. The network load affects the queuing time, which is not a constant factor. The queue time lengthens as network traffic volume grows. The communications that have arrived are queued and processed one at a time by an intermediary device, such as a router. Each communication will have to wait if there are several messages [4].

1.2.2.3 Jitter:

Jitter is another performance problem connected to delay. If distinct data packets experience various delays and the application utilizing the data at the receiver site is time-sensitive, we can essentially state that jitter is an issue (audio and video data, for example). The real-time programme that uses the packets experiences a jitter if the first packet is delayed by 20 ms, the second by 45 ms, and the third by 40 ms [5].

1.2.2.4 Throughput

The throughput measures the real speed at which data may be sent via a network. Although throughput and bandwidth in bits per second appear to be the same at first glance, they are not. Even if a link may have B bps bandwidth, we can only transfer T bps via it, where T is always less than B. In other words, throughput is a real assessment of how quickly we can deliver data, whereas bandwidth is a prospective measurement of a network. The devices linked to the link's end, for instance, could only be able to handle 200 kbps even though the link has a bandwidth of 1 Mbps. This signifies that the maximum bit rate we can transfer over this link is 200 kbps. Think of a freeway that can move 1000 automobiles per minute from one location to another. This number might be as low as 100 automobiles per minute if there is traffic congestion. 100 automobiles per minute pass through at a throughput of 1000 autos per minute [8].

1.2.2.5 Energy Efficiency

Due to environmental concerns as well as the practical considerations of the parties involved in the end-to-end route of wireless networks, energy efficiency has emerged as a new critical design requirement for wireless networks. The density of access points affects how much energy a network uses. Therefore, it is crucial for a network operator to lower the energy consumption of a communication system in order to decrease operational expenses. Although batteries for wireless terminals continue to grow in capacity, the rate of growth is not quick enough to meet customer expectations. So, in order to extend the lifespan of portable gadgets, an energy-efficient plan is required. As IoT services become more vitalized, a significant number of sensor nodes are installed. Once they are deployed, IoT nodes often need to operate for many months to several years without recharging. Given the significance of energy-efficient wireless networks, gathering current developments in this area is necessary to determine the direction of future research. We invite submissions from the academic community and business community for this special issue on current initiatives to address the problems [9].

1.2.2.6 Security

The significance of security in data transmission and networking cannot be disputed. Cryptography, the science and art of changing messages to make them safe and impervious to assault, is the foundation for networking security. Several features of network-based message exchange security can be provided through cryptography. These features include non-repudiation, secrecy, integrity, and authentication [4]. Similar to this, we must ensure security when sending communications in the form of texts, photographs, audio files, movies, etc. from one end to the other.

1.3 Different Parameters to be Send for End-to-End Communications Over Wireless Networks

Information today comes in different forms such as text, images, audio, and video.

1.3.1 Texts

Text in information technology is a sequence of characters that can be read by humans and then encoded into computer-readable forms like ASCII. Text is often separated from data that has not been character-encoded, such as programme code that is frequently referred to as being in "binary" and visual pictures in the form of bitmaps (but is actually in its own computer-readable format). Text is represented as a bit pattern, or a series of bits, in data transmissions (0s or 1s). To represent text symbols, many bit pattern sets have been developed. Coding is the process of representing symbols, and each set is referred to as a code. Unicode, the current standard coding system, employs 32 bits to represent every symbol or letter used in any language in the world. The first 127 characters of Unicode, generally known as Basic Latin, are made up of the American Standard Code for Information Interchange (ASCII), which was created in the United States many years ago [3].

1.3.2 Images

Bit patterns can also be used to represent images. An image is made up of a matrix of pixels, or "picture components," where each pixel is a tiny dot. The resolution affects how big a pixel is. A picture can be split, for instance, into 1000 or 10,000 pixels. Better resolution and a better representation of the image are present in the second scenario, but more memory is required to retain the image. Each pixel is given a bit pattern after being separated into individual pixels in a picture. The picture determines the pattern's size and value. Use 2-bit patterns, for instance, to display grayscale on four different levels. A black pixel can be represented by the numbers 00, 01, 10, and 11, whereas a light grey pixel can be represented by the number 10. Color picture representation may be done in a number of ways. A technique is known as RGB since it combines the three main hues of red, green, and blue to create each color. Each color's intensity is quantified, and a bit pattern is then allocated to it. Another technique, known as YCM, creates colour by mixing yellow, cyan, and magenta, three more main colours [8].

1.3.3 Audio

The recording or transmission of sound or music is referred to as audio. Audio differs from text, numbers, and visuals by its very nature. It is not distinct; it is continuous. We still produce a continuous signal even when we utilize a microphone to convert music or voice to an electric signal. We learn how to convert sound or music to a digital or analog signal in Chapters 4 and 5 [8].

1.3.4 Video

An image or movie that has been recorded or aired is referred to as a video. Video can be created as a single continuous entity (for example, by a TV camera) or as a collection of discrete pictures combined to create the illusion of motion. Once more, video can be converted to a digital or analog signal [7].

2. Related Works

Recent network analysis includes [30] [31] [32] [33] that deals with the matter of streaming medical video from mobile devices utilizing 4G wireless networks and introduces a framework for transmission and reception of medical multimedia systems over psychological feature radio networks. According to the most up-to-date LAN raincoat (Medium-Access-Control) analysis, the transmission and reception of mixed voice and knowledge traffic has been the most stressful. Recently, there has been a lot of interest in causing and receiving data-and-speech-containing video traffic. The authors propose a new approach to representing TXOP size. The TXOP limit is determined in [35], depending on the total number of MSDUs in each station's current queue. To improve their TXOP prediction, the researchers employed a window whose true queue length data had previously been revealed in [36]. In any event, neither of these technologies is adequate for large-scale video transmission. The goals are to ensure that the present queue size does not differ from the queue size for the next video frame, resulting in erroneous forecasts, and ii) historical information does not give a good prediction based on future behaviours from video sources (mainly for small video sequences). The researchers presented a cross-layer design strategy in [37] for providing and receiving telemedical services via wireless local area networks (WLANs). Their method eliminates telemedicine data transmission and assumes that telemedicine video is the sole video traffic sent over the networks. A three-layer strategy for ensuring network capacity for telemedicine applications is also included in their implementation. This method can cause the system's capacity to be drained and take too long if new types of telemedicine apps and ordinary traffic is added. The researchers described [38] uses two channels, one for data transmission and the other for telemedicine. device to convey brief alarm signals to the Access-Point (AP). The AP then sets a beacon to be broadcast to all apps on the network, indicating that resources for the backup device have been reserved. Through HCCA, the AP can gain access to the first channel. The presented technique, on the other hand, predicts that telemedicine data would be extremely scarce. That strategy may not be when there is a lot of telemedicine traffic; it's a good idea to have a backup plan sent from a group of users, as another route may not be available.

The research work in [39] [40] aims only at the scenario of WLAN providing patients, particularly in medical facilities. They won't take into account the possibility that a patient may utilize WLAN to send information about telemedicine outside of the hospital, to put it another way. Additionally, [41] discusses the use of medical data transmission while a video is not in the sending state or the use of additional, particular subcarriers for medical data transmission while a video is in the sending state. This research makes the assumption that WLANs are not devoted and do not need additional subcarriers for traffic splitting. According to research in [42], AVC (Advanced-Video-Coding) is mostly employed for dynamic signals, but SVC (Scalable-Video-Coding) is used for improved scheduling in medical applications, per a study in [43]. The study claims that AVC always offers great image quality. The main subject of the study is cellular networks that employ SVC. The idea of a token-dependent scheduling method that virtually totally eliminates collisions and hence increases channel efficiency was previously suggested in [43] to deliver speech and data traffic in a fully linked WLAN where every node can hear each other. By including video traffic, [44] extended their thorough investigation. To increase channel utilization, we changed EDCA to utilize tokens for all types of nodes and video node self-policing. The concepts presented in that study are insufficient to guarantee telemedicine QoS, as we have demonstrated; one feature of that method that was ignored was the capacity to regulate programmes that create urgent data. Furthermore, [46] was completely unaware of the problem of ensuring QoS for all types of traffic. The fundamental advantage of wireless networks over the advantage of wireless networks over wired users can roam around freely within the network utilizing their wireless devices. devices while still being able to access the internet and obtain whatever information they want. Users may move files from one device to another without having to link them physically. Wireless network installation takes less time and costs less money than wired network installation. In addition to these advantages, wireless networks are subject to the liabilities discussed in the sub-sessions. Demand for security is critical in every network. Network administrators are particularly concerned with preventing snooping attacks and ensuring that authentication requirements are met. To keep unauthorized users out of wireless networks, several businesses have implemented a range of security measures. The author introduced encrypting frames in [47], which substantially rely on earlier frames. Because the prior dependent frames are not encrypted, the approach lowers the encryption overhead. Select syntax components for encryption with regard to picture statistical material in inter and intra frames were introduced by the author in [48]. Within the frames, just a small number of syntaxes are ciphered with a low number of statistics, resulting in little encryption overhead. Non-equal encryption was also introduced in [49] by evaluating the foreground and background in video frames. The approach is only utilized in regions of interest that require strong security, despite the fact that the computing cost is lower. The author of [50] proposed encrypting syntactic components based on inter-frame interdependence among neighbouring frames. The method in this technique seeks to reduce error transmission due to encryption. The author of [51] developed a base layer encryption scheme that split the data and conducted an XOR operation on it. This method achieves a realistic overhead. In any case, unencrypted upper levels are vulnerable to video data leakage. The author of [48 proposed a strategy that compresses the maximum frequency level 1 and 2 sub-bands while encrypting the minimum frequency sub-band 3 by not compressing it. Despite the fact that this approach promises to have a low computing cost, it is used for wavelet-dependent video coding. In [23], the author proposed using view change recognition in P and B frames to choose syntax components for encryption. Previously, in [50], the author used motion syntax in the HEVC stream to encrypt object-related data that changes as the view changes. In any case, while the author's approach secures the security of the motion data as well as the frame-I data are not displayed. In addition, several selective encryption approaches have been used in all of the above-mentioned studies to reduce the encryption time expense while maintaining an acceptable trade-off in terms of security and other important conditions, such as format compliance and statistical significance, were met. In order to guarantee WLAN quality in 802.11ac for H.264 video, the author created MPCA (Multi-Polling-Controlled-Access) in [34]. MPCA is a highly efficient channel access device that benefits from both enhanced channel access and HCF-controlled access while also addressing their drawbacks. In the H.264 video stream, two levels—video coding and header data coding are distinguished. Video is encoded such that it may pass through the lowest layers with ease. A QAS transmission technique is also being developed in order to enhance the visual experience. In any case, this is ineffective in terms of managing network damage and necessitates an upgrade in security-based programmes. In [29], the author introduced the streaming of video in the surveillance-based applications depending on 3-Dimensional-HEVC in Internet-of-Things for data and audio transmitting channels. HEVC gives superior coding in online streaming compared to H.264 coding by 50% extra compression. Packet clustering and quantization techniques help to keep the picture's quality. NAMRTP (Network-Adaptive-Multisensory-Real-time-Transmission-Protocol) is a real-time surveillance system that sends multisensory data to a database under changing network circumstances. Anyways, HEVC does not offer an accessible bit stream. Thus, it cannot be improved for different users.

The H.264 encoder was introduced in [27], along with additional parameters such as for wireless multi-media transmission, RFN (Quantization-Parameter) and QP (Quantization-Parameter) are two different types of quantization parameters (Reference-Frame-Number) have been improved. By retaining the lowest processing latency and energy use with a regulated bit rate at sensor nodes, video packets may be sent via a network with the enhanced video quality. The frame-I frames are delivered without compression, whereas as part of the encoding procedure, frames B and P have been coded. According to [19], SVC (Scalable-Video-Coding) movies are streamed to a collection of in-vehicle networks to start LTE (Long-Term Evolution) communication from one car to another. A concealing strategy is used to cover up the missing video frames by repeatedly producing the previous frame until frame-I is created. When two vehicles are conversing, the cluster head fluctuates at random depending on the channel condition. This strategy offers better results for improving QoS but fails in the hiding strategy at the establishment end. In order to enhance network performance in traffic-dependent LTE systems that are both real-time and non-real-time, the author of [39] suggested a cross-layer scheduling approach. Motion correction and the H.264 encoder are both used in the reference frame. The QoE statistic is used to assess video quality, and it shows that it fails to maximize network throughput. Furthermore, the H.264 encoder compresses just a tiny quantity of data, reducing packet loss while increasing the number of nodes in the network. In [40], a CV-based video streaming strategy for reducing video bandwidth by minimizing excessive chunk requests and content overloads is proposed. As a consequence, CV will be able to manage the average length of content download requests for large amounts of data. The streaming source checks to verify if CP is aware of the typical view time for the material before providing massive volumes of content. As a consequence, CP provides the value of playing time based on the introduced approach, and the user's terminal provides the average view. When this process is finished, the CP and the user's terminal start sending video data to the user. In each instance, internet traffic is boosted automatically; the procedure must be tweaked to operate with diverse programmes. According to distortion and delay circumstances, the author of [21] proposed a retry limit adaption strategy in video streaming with the resending of video packets. The sensor node sends the message again with the correct quality parameters as a result. Thus, the feedback of the receiver is not considered with respect to the distortion and delay in video packet transmission. And the distortion is linked to the delay and drop ratio at the time of expiry, which seeks to reduce video transmission costs.

Anyway, the number of retry attempts causes the maximization of process time and huge traffic of data. An EQBA was provided by the author of [22]. (Energy-Quality-aware-Bandwidth-Aggregation) method for multiple video transmission channels in wireless networks that incorporates both delay and energy restrictions. There are three different categories of sensor nodes: A bandwidth aggregation strategy that takes quality-aware transmission into account, several sources that deliver data to mobile devices in a single video flow, energy conservation, and delays into account, and finally. In any event, EQBA is unable to maintain the rate of encoding as well as the connection between QoS indicators and mobile energy. Energy consumption, which has received a lot of attention, is one of the problems that has emerged as a critical issue in wireless networks. Furthermore, because wireless networks have a high need for energy consumption, energy consumption is a compromise between performance and cost. Multiple transmissions are not the topic of this study, although the researcher did build a model for the energy consumption of the video in [43] based on the video features and the channel status. In [46], the application layer is where energy usage is optimized; in this case, the video encoder settings were chosen based on the specific channel condition. It decreases packet loss and prevents network congestion. [39] suggests a method for distributing various FEC (forward error correction) rates across the frames in a given collection of images, and this method aids in the packet with the lowest priority being deleted uses quasi quadrature modulation to decrease interference. Based on a thorough investigation into the tradeoff between energy usage and visual quality, they developed a system that distributes the Adaptive Modulation Coding (AMC) has been used for multiple levels of video encoding [31]. [22] optimizes the FEC coding rate and bit rate between the specified nodes on the given pathways to help maximize video quality in a device-to-device network with an energy restriction. In link adaption algorithms and optimal power allocation are purposed with the subject QoS (Quality- of-

Service), however, this methodology fails miserably since the video sequence may require the various QoS and it might reflect the unequal frame are not taken into the account.

The table (Table 1) below, which is separated into four columns, compares the methodologies described above. The article is in the first column; the technique and its defects are in the second column; the primary benefit of a specific approach is in the third column, and the method's weaknesses are in the fourth column.

Table 1. Compares the Methodologies

Paper No.	Implementation Methodologies	Advantage	Disadvantage
7	This research work considers small cells; it studies the impact of 4g and small cells. This research work considers the heterogeneous network that includes the macrocell along with the femtocells. This paper aims to improve the QoS using the femtocell.	The use of femtocells shows significant improvisation in the m-health field when compared to the typical microcellular network.	Moreover, this isn't robust in the case of critical m-health applications.
11	In this paper, a novel video encoding system is proposed for replacing the video codes currently used. It uses the H.265 codec.	The main advantage was that it was capable of providing enough bandwidth.	Optimal streaming is not possible for real-time scenarios.
13	An optimization method is proposed that can identify the available video sources and select them automatically for transmission. It uses a ranking algorithm that can work with the cross-layer adaption strategy for multiple screams. The main intention here was to adjust the overall throughput dynamically so that they can meet the absolute bandwidth and high-quality video can be provided.	The main advantage of this method is that it automatically chooses the best source to attain end-to-end video quality.	It does not perform ideally when it comes to source to attain end-to end video quality.
15	The video and audio traffic are separated in this study. In this scenario, a scheduler is built that can access the schedule for the chosen media, allowing for both non-real-time and real-time performance through distributed contention and centralized pooling.	The key benefit is that real-time traffic patterns are easier to forecast and follow.	Bandwidth mechanism and efficient management are the method's greatest drawbacks.
16	An FHCF-referenced scheduling technique is provided in this study. It aspires to be equitable for both VBR and CBR flows. The mobile stations are tuned using queue length estimation.	For a wide variety of network loads, FHCF delivers high fairness while fulfilling bandwidth and latency needs. By addressing the latency and bandwidth requirements for the massive network loads, this strategy delivers a considerable measure of fairness.	For error-prone wireless channels, it must incorporate a robust and adaptable algorithm.

18	An expert station connected to a specific WLAN access point was used to showcase the EDCA cross-layer design process. It's excellent for use with wireless networks to view patients.	The cross-layer design strategy supplies the telemedicine application's traffic flows with distinct priorities in order to allocate video and QoS.	While the low-priority users create a large demand on the system, this strategy fails to provide priority access for higher priority traffic.
19	This technique enables QoS variations for multiple packets and flows from the same service category through a wireless connection that isn't supported by the present method. The variance includes the relevance of each packet and flow to the outbound QoE, and this study gives data prioritization strategies for medical videos in wireless networks.	This study also outlines the integration of the new resolution into the OMNeT++ simulator via WLAN.	Implementation is the process of managing policies in real-time to fulfill the needs of each application in a user-friendly way. Furthermore, the current policies, including intra-frame versions, must be developed with a high level of fine-grained priority.

3. Conclusion

In this research, we reviewed the various QoS-oriented data transmission methodologies currently in use in wireless networks. Additionally, this research study examines the various wireless networks' QoS deficiencies. Here, we go over the numerous QoS-improving methods put out for wireless networks.

The previously mentioned QOS approach improves data transmission by making it more flexible and effective, but there are still a number of research concerns that need to be covered, such as how to best balance the trade-off between fairness, priority, and channel efficiency. Additionally, these techniques need to be assessed in various scenarios.

Reference

[1] Tim Zimmerman, Christian Canales, Bill Menezes “Magic Quadrant for the Wired and Wireless” 17 October 2017.

[2] Kirsner, Scott. “The Legend of Bob Metcalfe,” Wired, 6.11 (November 1998), 182-186.

[3] R. B. Marks, I. C. Gifford and B. O'Hara, "Standards in IEEE 802 unleash the wireless Internet," in *IEEE Microwave Magazine*, vol. 2, no. 2, pp. 46-56, June 2001.

[4] IEEE P802.11s task Group IEEE Unapproved draft standard P802.11s/D4.0, Dec (2010)

[5] H. Huang, "Flexible Wireless Antenna Sensor: A Review," in *IEEE Sensors Journal*, vol. 13, no. 10, pp. 3865-3872, Oct. 2013.

[6] J. Pang, B. Greenstein, M. Kaminsky, D. McCoy, and S. Seshan, "Wifi-Reports: Improving Wireless Network Selection with Collaboration," in IEEE Transactions on Mobile Computing, vol.9, no. 12, pp. 1713-1731, Dec. 2010. doi: 10.1109/TMC.2010.151.

[7] Karnik and K. Passerini, "Wireless network security - a discussion from a businessperspective," Symposium, 2005 Wireless Telecommunications, Pomona, CA, 2005, pp. 261-267.doi: 10.1109/WTS.2005.1524796.

[8] Singh, Madhusudan& Lee, Sanggon& Lee, Hoon-Jae. (2011). Performance of Mobility Models for Routing Protocol in Wireless Ad-hoc Networks. Journal of information and communication convergence engineering. 9.10.6109/jicce.2011.9.5.610.

[9] Bicket, John & Aguayo, Daniel & Biswas, Sanjit& Morris, Robert. (2005). Architecture and Evaluation of an Unplanned 802.11b Mesh Network. 11th Annual International Conference on Mobile Computing and Networking 2005 (MOBICOM 2005). 31-42. 10.1145/1080829.1080833.

[10] Z. Yan, L. Jijun, H. Honglin. Wireless Mesh Networking, Architectures Protocols and Standard (Auerbach Publications, USA, 2007).

[11] C. Cicconetti, L. Lenzini, E. Mingozzi and C. Eklund, "Quality of service support in IEEE 802.16 networks," in *IEEE Network*, vol. 20, no. 2, pp. 50-55, March-April 2006.
[12] Hua Zhu, Ming Li, I. Chlamtac and B. Prabhakaran, "A survey of quality of service in IEEE 802.11 networks," in *IEEE Wireless Communications*, vol. 11, no. 4, pp. 6-14, Aug. 2004.
[13] I.U. Rehman , N.Y. Philip , R.S.H. Istepanian , Performance analysis of medical video streaming over 4G and beyond small cells for indoor and moving ve- hicle (ambulance) scenarios, in: Proc. of the 4th International Conference on Wireless Mobile Communication and Healthcare (MobiHealth), 2014 .
[14] S.M.S. Al-Majeed , S.K. Askar , M. Fleury , H.265 codec over 4G networks for telemedicine system application, in: Proc. of the 16th International Conference on Computer Modelling and Simulation, 2014.
[15] S. Cicalo , et al. , Multiple video delivery in M-health emergency applications, IEEE Trans. Multimedia 18 (10) (2016) 1988–2001 .
[16] I.U. Rehman , N.Y. Philip , M-QoE driven context, content and network aware medical video streaming based on fuzzy logic system over 4G and beyond small cells, in: Proc. of EUROCON, 2015 .
[17] D. Ouattara , et al. , A QoS-control framework for medical multimedia data transmission in CRN environment, in: Proc. of the IEEE Symposium on Com- puters and Communication (ISCC), 2014.
[18] H. Zen , et al. , Adaptive segregation-based MAC protocol for real-time multime- dia traffic in WLANs, in: Proc. of the IEEE ICON, 2007 .
[19] R. Haywood , et al. , Investigation of H.264 video streaming over an IEEE 802.11e EDCA wireless testbed, in: Proc. of the IEEE ICC, 2009
[20] P. Ansel , et al. , FHCF: a simple and efficient scheduling scheme for IEEE 802.11e wireless LAN, Mobile Netw. Appl. J. 11 (3) (2006) .
[21] E. Supriyanto , et al. , Cross layer design of wireless LAN for telemedicine appli- cation considering QoS provision, in: G. Graschew, T.A. Roelofs (Eds.), Advances in Telemedicine: Technologies, Enabling Factors and Scenarios, InTech Publish- ers, 2011.
[22] C. Chigan , V. Oberoi , Providing QoS in ubiquitous telemedicine networks, in: Proc. of the 4thInternational Conference on Pervasive Computing and Commu- nications Workshops (PERCOMW), 2006 .
[23] A. Panayides , I. Eleftheriou , M. Pantziaris , Open-source telemedicine platform for wireless medical video communication, Int. J. Telemed. Appl. 2013 (2013) Article ID 457491 .
[24] Lin, Di &Labeau, Fabrice. (2012). An Algorithm That Predicts CSI to Allocate Bandwidth for Healthcare Monitoring in Hospital's Waiting Rooms. International journal of telemedicine and applications. 2012. 843527. 10.1155/2012/843527.
[25] Ojanperä, Tiia&Uitto, Mikko&Vehkaperä, Janne. (2014). QoE-based management of medical video transmission in wireless networks. IEEE/IFIP NOMS 2014 - IEEE/IFIP Network Operations and Management Symposium.
[26] P. Wang and W. Zhuang, "A token-based scheduling scheme for WLANs supporting voice/data traffic and its performance analysis," in *IEEE Transactions on Wireless Communications*, vol. 7, no. 5, pp. 1708-1718, May 2008.
[27] P. Koutsakis , Token- and self-policing-based scheduling for multimedia traffic transmission over WLANs, IEEE Trans. Veh. Technol. 60 (9) (2011).
[28] H. Shen, L. Zhuo, and Y. Zhao, “An efficient motion reference structure based selective encryption algorithm for h.264 videos,” IET Information Security, vol. 8, no. 3, pp. 199–206, May 2014
[29] Y. Zhao, L. Zhuo, M. Niansheng, J. Zhang, and X. Li, “An object based unequal encryption method for h.264 compressed surveillance videos,” in 2012 IEEE International Conference on Signal Processing, Communication and Computing (ICSPCC 2012), Aug 2012, pp. 419–424.
[30] Y. Zhao, L. Zhuo, M. Niansheng, J. Zhang, and X. Li, “An object based unequal encryption method for h.264 compressed surveillance videos,” in 2012 IEEE International Conference on Signal Processing, Communication and Computing (ICSPCC 2012), Aug 2012, pp. 419–424
[31] W. Wang, M. Hempel, D. Peng, H. Wang, H. Sharif, and H. H. Chen, “On energy efficient encryption for video streaming in wireless sensor networks,” IEEE Transactions on Multimedia, vol. 12, 417-426,Aug 2010.
[32] A. S. Tosun and W.-C. Feng, “Lightweight security mechanisms for wireless video transmission,” in Proceedings International Conference on Information Technology: Coding and Computing, Apr 2001,157–161.

[33] N. Al-Hayani, N. Al-Jawad, and S. Jassim, “Simultaneous video compression and encryption for real-time secure transmission,” in 2013 8th International Symposium on Image and Signal Processing and Analysis (ISPA), Sept 2013, pp. 240–245.

[34] Y. W. I. H. Karthik. Thiyagarajan, Kamal El-Sankary, “Low complexity multimedia encryption,” International Journal of Computer Network and Information Security(IJCNIS), vol. 8, no. 4, pp. 1–13, Apr 2016.

[35] H. H. Mohammed A. Saleh, NooritawatiMd Tahir, “Moving objects encryption of high efficiency video coding (hevc) using aes algorithm,” Journal of Telecommunication, Electronic and Computer Engineering, vol. 8, no. 3, pp. 31–36, 2016.

[36] C.Y. Chang , H.C. Yen , C.C. Lin , D.J. Deng , QoS/QoE support for H. 264/AVC video stream in IEEE 802.11 ac WLANs, IEEE Syst. J. (2015) .

[37] G. Kokkonis , K.E. Psannis , M. Roumeliotis , D. Schonfeld , Real-time wireless multisensory smart surveillance with 3D-HEVC streams for internet-of-things (IoT), J. Supercomput. 73 (3) (2017) 1044–1062 .

[38] H. Hassan , M.N. Khan , S.O. Gilani , M. Jamil , H. Maqbool , A.W. Malik , I. Ah- mad , H. 264 encoder parameter optimization for encoded wireless multimedia transmissions, IEEE Access. 6 (2018) 22046–22053 .

[39] E. Yaacoub , F. Filali , A. Abu-Dayya , QoE enhancement of SVC video streaming over vehicular networks using cooperative LTE/802.11 p communications, IEEE J. Sel. Top. Signal Process. 9 (1) (2015) 37–49 .

[40] M. Nasimi , F. Hashim , A. Sali , R.K. Sahbudin , QoE-driven cross-layer downlink scheduling for heterogeneous traffics over 4G networks, Wirel. Personal Com- mun. 96 (3) (2017) 4755–4780 .

[41] T.K. Kim , J.H. Kwon , E.J. Kim , Categorization-based video streaming for traffic mitigation in content delivery services, Multimed. Tools Appl. 76 (23) (2017) 25495–25510 .

[42] F. Babich , M. Comisso , R. Corrado , Fast retry limit adaptation for video dis- tortion/delay control in IEEE 802.11 e distributed networks, Ad Hoc Netw. 36 (2016 Jan 31) 229–243 .

[43] J. Wu , B. Cheng , M. Wang , J. Chen , Energy-efficient bandwidth aggregation for delay-constrained video over heterogeneous wireless networks, IEEE J. Sel. Ar- easCommun. 35 (1) (2017 Jan 1) 30–49 .

[44] M. A. Sedaghat, R. R. Mueller, R. R. Mueller, and G. Fischer, “A novelsingle-RF transmitter for massive MIMO,” in Proc. WSA, Erlangen, Germany, Mar. 2014,

[45] C. Huang, G. C. Alexandropoulos, A. Zappone, M. Debbah, and C. Yuen, “Energy efficient multi-user MISO communication using low resolution large intelligent surfaces,” in Proc. IEEE GLOBECOM Workshops, Abu Dhabi, UAE, Dec. 2018, pp. 1–6.

[46] S. Hu, K. Chitti, F. Rusek, and O. Edfors, “User assignment with distributed large intelligent surface (LIS) systems,” in IEEE WCNC, Barcelona, Spain, Apr. 2018,1–6.13

[47] Q. Wu and R. Zhang, “Intelligent reflecting surface enhanced wireless network via joint active and passive beamforming,” [Online] https://arxiv.org/abs/1810.03961, 2018..

[48] Pundalik Chavan, K Satyanarayana Reddy “Integrated Cross Layer Optimization Approach For Quality Of Service Enhancement In Wireless Network” Published in ISSN: 0976-5166, Volume-12 Issue-4, August 2021

[49] Pundalik Chavan, K Satyanarayana Reddy “QoS Aware Video Transmission in Wireless Network: Successful and Failure Existing Technique” Published in ISSN: 2277-3878, Volume-8 Issue-5, January 2020

[50] J. Suneetha, Husna Tabassum, Pundalik Chavan, and N. R. Deepak “Prediction of Cardiac Diseases Using Machine Learning Algorithms” Published in Advances in Intelligent Systems and Computing , ISSN: 0976-5166, Volume-1413, Proceedings of 4th ICSCSP 2021, Sprinzer Publication, https://doi.org/10.1007/978-981-16-7088-6_2/

[51] Hanumanthappa H , Pundalik Chavan “An Hybrid Approach for Identification of Breast Cancer using Mammogram Images” Published in Valume-6 ISSUES-1 January-2018