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RESEARCH ARTICLE

SURVEY OF QUALITY OF SERVICE PARAMETERS AND ISSUES IN 802.11 WIRELESS LAN

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ABSTRACT

Quality of service (QoS) is a key issue of today's IP systems. Numerous structures have been proposed to give benefit separation in the Internet. In the meantime, the Internet is ending up noticeably more heterogeneous because of the current blast of remote systems. In remote situations, data transfer capacity is rare and channel conditions are time-fluctuating and now and then profoundly loss. Numerous past research works demonstrate that what functions admirably in a wired system can't be specifically connected in the remote condition. In spite of the fact that IEEE 802.11 remote LAN (WLAN) is the most generally utilized WLAN standard today, it can't give QoS support to the expanding number of sight and sound applications. Subsequently, countless QoS improvement plans have been proposed, every one concentrating on a specific mode. This paper surveys various works on 802.11 protocols and exhibits a study of flow research exercises. Initially, we break down the QoS restrictions of IEEE 802.11 remote MAC layers. At that point, diverse QoS upgrade methods proposed for 802.11 WLAN are depicted and characterized alongside their preferences/disadvantages. At last, the up and coming IEEE 802.11e QoS upgrade standard is presented and examined in detail.

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INTRODUCTION

Because of their bendy and occasional price infrastructure, Wi-Fi local location networks (LANs) are poised to enable an expansion of delay-sensitive multimedia packages, consisting of videoconferencing, emergency services, surveillance, telemedicine, far flung coaching and education, augmented fact, and entertainment. however, present Wi-Fi net- works provide simplest constrained, time-varying pleasant of service (QoS) for put off-touchy, bandwidth- intense, and loss-tolerant multimedia packages. happily, multimedia applications can cope with a certain amount of packet losses depending at the series traits and error concealment techniques to be had at the receiver. consequently, in contrast to document transfers, real-time multimedia applications do now not require entire insulation from packet losses, but alternatively that the application layer cooperate with the decrease layers to pick out the choicest wireless transmission approach that maximizes multimedia overall performance. IEEE802.eleven Wi-Fi neighborhood place community (WLAN) is a shared- medium communique community that transmits data over wireless links for all IEEE802.11 stations in its transmission range to get hold of. it's far one of the maximum deployed Wi-Fi networks inside the international and is excessive in all likelihood to play a chief function in multimedia domestic networks and next- technology Wi-Fi communications. the main function of the IEEE 802.11 WLANs is its simplicity, scalability and robustness towards failures due to its dispensed nature. IEEE802.11 wireless networks can be configured into two special modes: advert hoc and infrastructure modes. In advert hoc mode, all wireless stations in the conversation variety can communicate immediately with every other, while in infrastructure mode, an get right of entry to factor (AP) is needed to connect all stations to a Distribution gadget (DS), and each station can speak with others thru the AP. IEEE802.11 standards sincerely consist of a circle of relatives of requirements. Among them, the authentic widespread called IEEE802.11 affords the data charges up to two Mbps at 2.4 GHz ISM band (Peng, Yuhuai *et al*., 2013). Later, IEEE802.11 running institution posted its better version named IEEE802.11b that extends the records charge up to eleven Mbps at this ISM band (Kosek-Szott *et al*., 2013). Its high-velocity version at 5 GHz UNII bands, i.e. IEEE802.11a, become also described later (Touil, Hicham and Youssef Fakhri, 2014). IEEE802.11a standard can gain information rate of up to 54Mbps by way of the use of OFDM (Orthogonal Frequency department Multiplexing) modulation technique at physical layer. Today, IEEE802.eleven wireless networks are extensively set up at houses, company buildings and warm spots. With the programs over 802.11 WLAN increasing, the customers demand increasingly new functions and functions of IEEE802.eleven WLAN. One very vital feature is the aid of packages with first-rate of carrier (QoS) in 802.eleven Wi-Fi

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networks. So, the aid of video, audio, actual- time voice over IP and different multimedia packages over 802.eleven WLAN with QoS necessities is the key for 802.11 WLAN to achieve success in multimedia domestic networking and destiny Wi-Fi communications. Many researchers have proven a lot hobby in growing new medium access schemes to aid QoS (Blanes *et al*., 2015; Kaippallimalil *et al*., 2015). Consequently, IEEE 802.11 operating organization is presently operating on a new popular known as 802.11e to beautify the original 802.11MAC (Medium access manage) sub layer to help QoS (Malik *et al*., 2015). The original 802.11 WLAN MAC sub layer employs a DCF (dispensed Coordination function), which is primarily based on CSMA/CA (service sense a couple of access/Collision Avoidance), for medium get entry to, and is quality regarded for its asynchronous first-class-attempt records switch. so as to aid QoS in 802.eleven WLAN, the upcoming IEEE802.11e general adds a brand new characteristic called HCF (Hybrid Coordination characteristic) which includes both controlled competition- unfastened and competition-based totally channel get entry to methods in a unmarried channel get right of entry to protocol. The HCF makes use of a competition-based totally channel get admission to method called the enhanced DCF (EDCF) that operates concurrently with a controlled channel get right of entry to mechanism that is based totally on a valuable polling mechanism. HCF helps each prioritized and parameterized medium get admission to.

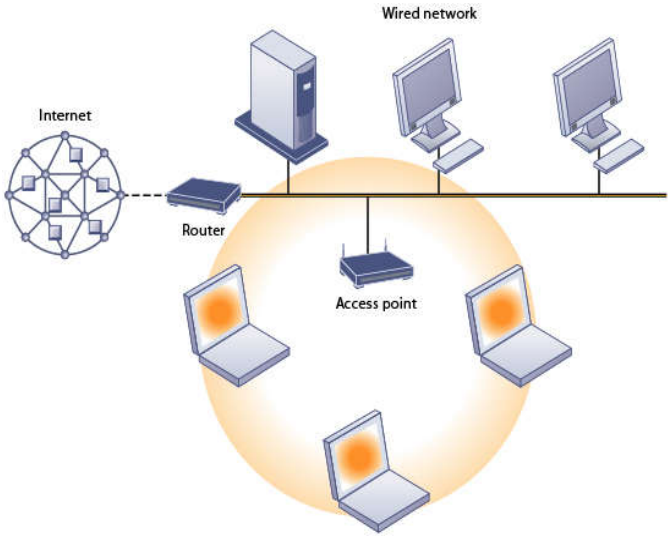

Fig.1. Architecture of IEEE 802.11 Wirelesses LAN

802.11 MAC Layer

The authentic 802.11 MAC layer is built around coordination functions that manipulate medium access by means of the use of allotted coordination and centralized coordination. Within the allotted Coordination feature (DCF) (Peng, Yuhuai *et al*., 2013), the access control mechanisms are positioned at the station rather than the factor Coordination characteristic (PCF) in which manage is centralized to the get right of entry to point (AP). In 802.11 networks, DCF is continually used asynchronous records services and PCF is usually used time bounded services.

1. Collision management in 802.11

In 802.3 Ethernet networks, the number one approach for medium get admission to is service feel more than one get entry to with Collision Detection (CSMA/CD) wherein collisions are detected on the channel, and are treated through lower back-off counters that reduce destiny collisions via randomly increasing window sizes. Detection and restoration are green and viable in stressed networks due to the high bandwidth and occasional packet times of modern networks. This "dependable" nature of stressed networks notably reduces the impacts of collisions (Pathan *et al*., 2017). In the wireless realm, however, interference can motive large noise resulting in frequently corrupted packets. Even more difficult is the reality that channel sensing isn't possible considering that maximum radios can't simultaneously ship and acquire. For those motives collision detection isn't possible for 802.11Wi-Fi networks that motivates the need for CSMA with Collision Avoidance (CSMA/CA). CSMA/CA works on the precept of listening earlier than transmitted. it is an asynchronous, connection- much less, message passing mechanism which could supply to the pleasant attempt service. So this could cause an set of rules by which all stations are allowed to gain access to the medium in a rather truthful manner and minimizing collisions using DCF or PCF, or each. This set of rules is based on inter-frame spacing to coordinate the communication of the stations. 4 unique time periods are described as follows:

- **SIFS (Shortest Inter-frame area):** the wait time between the closing transmission and excessive precedence transmissions together with Request to send (RTS) and clear to send (CTS) frames and advantageous acknowledgments (ACKs). Fine ACK (Peng, Yuhuai *et al*., 2013) frames are given priority in order that currently communicating stations are given instantaneous feedback on the maximum currently sent body. due to the fact RTS and CTS frames are control frames, they are evidently given precedence over different body kinds.

- **PIFS (PCF Inter-frame space):** the minimal idle time for contention-free get admission to together with PCF; this is discussed in element below. This c programming language lets in the factor coordinator priority over stations.

- **DIFS (DCF Inter-frame area):** the minimal idle time for competition based access including DCF. Any station may declare the medium after this time c programming language.

- **EIFS (prolonged Inter-frame space):** minimum wait time for a station that receives corrupted frames.

The time intervals provide DCF and PCF to have interaction seamlessly and with as few collisions as viable by way of always assuming the following dating: slot time < SIFS < PIFS < DIFS < EIFS. The diagram shows that courting of the inter-frame spaces to the get entry to algorithms which may be discussed beneath. In determine 1.2 taken from, it is clean that components that are managed by using smaller time put off durations may have a wonderful advantage over those that use longer time periods. within the following sections, it is going to be shown how these inter-frame areas is the idea for supplying manipulate mechanisms with precedence over stations, as well as imparting station precedence inside the absence of centralized control.

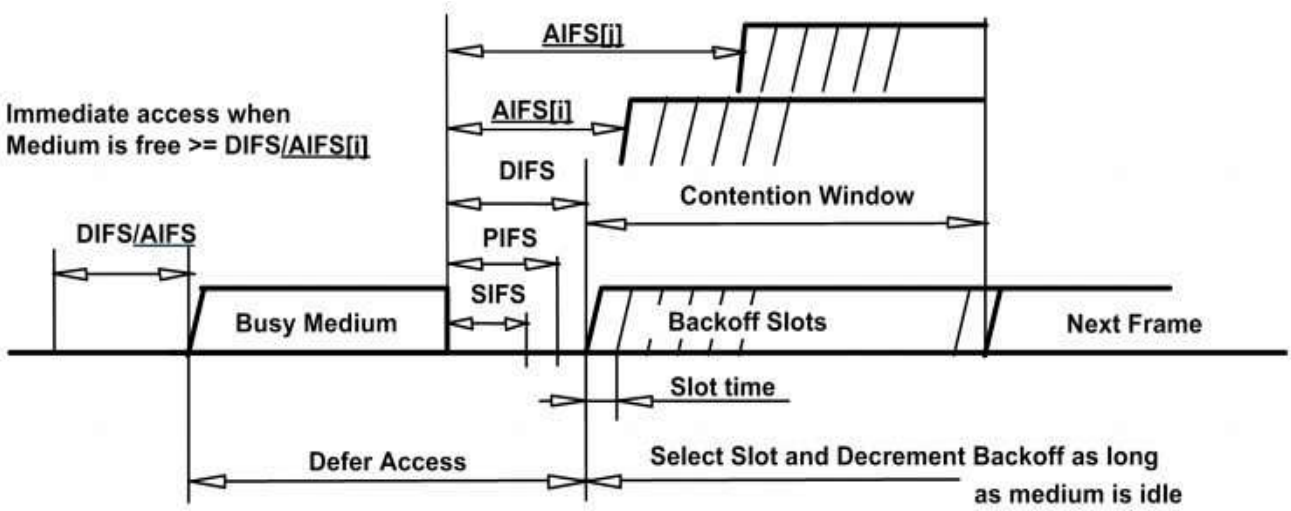

Figure (2802.11 transmission interval)

2. DCF

DCF allows stations to transmit without a principal coordinator. when a station wishes to transmit, and has sensed that the medium is loose; it waits for a DIFS and transmits. If all through the DIFS, the medium becomes busy, it begins decrementing a back-off counter this is described by the competition Window (CW). The CW starts off evolved same to CWmin and ends identical to CWmax. After each consecutive collision, the counter is ready to a random value between 0 and CW. on every occasion a collision happens the CW is extended until it equals CWmax. If the CW reaches 0, and the medium is still loose, then the station begins transmitting. If for the duration of the countdown, the medium is seized by way of any other station, the station stops the counter and resumes after the transmission period. If the station senses the medium to be loose, reaches a counter price of zero, and starts off evolved a transmission that outcomes in a collision (no ACK received), the station will pick out a brand new CW fee. DCF also consists of an non-compulsory RTS/CTS mechanism to eliminate the hidden station hassle. The hidden station trouble occurs when stations can sense transmissions of the AP, but no longer of each other. because of their inability to acquire (Peng, Yuhuai *et al*., 2013) every deferment's alerts, the two stations can claim the medium concurrently, and could reason a collision at a imperative destination. To save you this, before sending a frame, a station transmits a RTS packet and then receives a CTS packet from the principal station. each of these frames consist of records concerning the time it'll take to ship the frames, which permits other stations to set a timer known as the network Allocation Vector (NAV) since the medium can be busy as a minimum for that period of time. After that point, stations start ordinary time c language waiting, and lower back-off counter decrementing. due to the fact RTS and CTS frames are allowed to be transmitted after a SIFS, they've precedence over normal DCF transmissions.

3. PCF

In PCF, medium get admission to is controlled through a factor Coordinator (laptop). The computer controls get entry to by way of looking for stations wishing to transmit during a contention period (CP), and polling stations throughout a contention unfastened period (CFP). Together the CP and the CFP form a great frame which repeats for each time duration. during the CFP (Peng, Yuhuai *et al*., 2013), PCF is used to manipulate get admission to, and then in the course of the CP, DCF is used. The CFP part of the great body starts off evolved with a beacon frame that contains management records including protocol parameters and time synchronization. After the beacon frame has been transmitted, the computer polls stations in a round-robin way, and upon a success response, permits the station to transmit both an ACK indicating it has nothing to send, or a information+ACK body. Having received no reaction from a station the computer actions on, and the station isn't allowed to transmit until the CP, or in the course of the next CFP. The CFP ends when the time period exact by using the beacon body expires, or a CFP-cease body is dispatched. After the CFP has ended, a ordinary DCF length proceeds. however, due to the fact PIFS is shorter than DIFS, the laptop can immediately seize the medium and begin every other CFP if favored. Even as PCF become intended to provide a form of QOS to 802.11 networks, it's far normally agreed that it fails to provide this service properly. Despite the fact that PCF receives priority over DCF since the PIFS is usually much less than the DIFS, it suffers from the truth that man or woman community flows cannot be singled out for prioritization for the reason that pc polls in a round-robin fashion. Excessive precedence can be given to man or woman stations, but affecting service on a extra granular stage is impossible with PCF. Also, polling can bring about excessive overhead and massive stop-to-stop put off while the wide variety of stations is big.

Protocols of IEEE 802.11 circle of relatives

There are several distinctive protocols in IEEE 802.11 circle of relatives are as:

- **802.11 —** applies to Wi-Fi LANs and offers up to 1 or 2 Mbps transmission inside the 2.four GHz frequency the use of frequency hopping unfold spectrum (FHSS) and direct collection spread spectrum (DSSS) strategies.
- **802.11a —** an extension to 802.eleven that applies to wireless LANs and provides up to fifty four-Mbps statistics quotes inside the 5GHz frequency band. It uses an orthogonal frequency division multiplexing

(OFDM) encoding scheme. It maintained complete backward compatibility with these requirements.

- **802.11b —** also an extension to IEEE 802.11 that applies to WLANS and provides as much as 11Mbps records transmission within the 2.four GHz frequency band. It makes use of only DSSS encoding scheme.
- **802.11e —** this fashionable is defines as the exceptional of service (QOS) (11) that can most effective assist for LANs and an enhancement to the 802.11a and 802.11b WLAN protocol. It adds QOS and multimedia capabilities that handiest aid to the existing IEEE 802.11b protocol.
- **802.11g —** it is applies to wireless LANs and offers up to 54-Mbps data rates inside the 2.4 GHz bands for transmission over brief distances.
- **802.11n —** 802.11n builds from previous IEEE 802.11 requirements. It's far a brand new multi-streaming modulation technique. It is real pace might be a hundred Mbps (Touil *et al*., 2014) and up to four-5 times quicker than 802.11g protocol. it is able to deliver statistics costs as much as forty 3.3 Mbps.
- **802.11ac —** 802.11ac builds from IEEE 802.eleven standards. The 802.11ac protocol operates simplest inside the 5 GHz frequency band and capabilities aid for wider channels (80MHz and 160MHz) can achieve its better Wi-Fi speeds.
- **802.11ad —** 802.11ad is a Wi-Fi specification under improvement a good way to operate inside the 60GHz frequency band and allow for a lot higher transfer quotes than preceding IEEE 802.11 protocol. It may transfer facts rate as much as maximum 7Gbps.
- **802.11r -** 802.11r additionally referred to as fast simple carrier Set (BSS) Transition which could supports Vo Wi-Fi handoff among get right of entry to points to allow VoIP roaming on a Wi-Fi network.
- **802.1X —** it's miles an IEEE preferred for port-primarily based community access control that allows network administrators to limited use of IEEE 802 LAN provider get right of entry to factors to relaxed communique among authenticated and licensed gadgets.

Applications of IEEE 802.11n WLAN

The pre-widespread 802.11n networks have been installed maximum regularly in universities, which might be technologically competitive and wherein exceedingly mobile pupil customers are probably to have the maximum contemporary 802.11n person associations in their laptops. a few university and commercial enterprise campuses have also used the wireless mesh era supported with the aid of many early 802.11n products for backhaul applications: Wi-Fi LAN traffic can be forwarded over the air from get right of entry to factor to get admission to factor (AP), each indoors and outdoors, until accomplishing a wired Ethernet transfer at the brink of the Wi-Fi community. This gets rid of the want to connect every AP to an Ethernet transfer the use of physical cabling, saving large hard work prices, switch-port prices and time. Similarly, 802.11n is likewise accepted in healthcare corporations. Clinical environments often want the more bandwidth to download excessive-decision scientific pix and to allow cellular caregivers to update electronic patient charts as they move from room to room. Many studies corporations expects that by the closing a part of this 12 months, almost 40 percentage of wireless routers shipped will support 802.11n (Peng, Yuhuai *et al*., 2013), illustration the generation more conventional. Overall performance tracking and trying out gear are an specifically critical factor for early company installations. One purpose is that 802.11n has yet to be verified on a completely huge scale while assisting a big blend of client sorts and diverse mixtures of the seller-elective features allowed via the same old.

Latest challenges in 802.11

Even though 802.eleven had been widely and rapidly followed, safety problems have continued to appear. network managers will undoubtedly be asked to touch upon pace, expandability and security troubles, mainly in any Wi-Fi LAN. WEP Protocol has been completely damaged and the IEEE is forging a successor to it based on 802.1X. although the final shape of the new and progressed velocity and safety framework has now not but grow to be apparent, it will almost primarily based on port-based totally community get right of entry to control protocol.

- RF link fine: On a stressed out Ethernet, it is reasonable to transmit a body and expect that the vacation spot receives frame well. Radio hyperlinks are one of a kind even slender band transmissions are problems to noise and interference, in which its frequencies used as an unlicensed device may be considered that interference will be exist and paintings round to it. The designers of this protocol 802.11 taken into consideration methods to work around that radiation from microwave ovens and other exclusive RF resources. Further to the noise, multipath fading might also lead to conditions in which frames cannot be transmitted because a node movements right into a dead spot.
- Hidden Node problem: In Ethernet networks, stations rely on the reception of transmissions to carry out the provider sensing functions of CSMA/CD (30). In Wires LAN comprise the alerts and transmitted packets to every and every network nodes however in Wi-Fi networks have interference can cause noises resulting in frequently corrupted packets, so on occasion to the factor where each node might not be able to communicate with every different node within the wireless community.
- diverse performance problems: Troubleshooting wireless networks is just like troubleshooting stressed out networks is plenty extra complex. subsequently for complex networks numerous overall performance related issues stand up are:

a) Tuning a Wi-Fi network is tied intimately to a number of parameters in the specification. To recognize the behavior of any network and what effect the optimizations will have calls for information of what those parameters definitely do.
b) Differences between the Wi-Fi network surroundings and the conventional wired surroundings create challenges for network protocol designers which are faces distinct variety of the hurdles in 802.eleven.
c) Protocols over 802.11 over excessive visitors and coffee data prices suffer from excessive congestion. it is found that higher layer protocols along with TCP result in overreaction of routing protocols lowering the throughput.

QoS Parameters in 802.11

1. Resource Allocation

Essentially, many QoS troubles stem from the problem of resource allocation. A computer network consists of various assets—inclusive of hyperlinks of various bandwidths, routers with various buffer sizes—which can be shared by the special community applications and users. Packet delays and losses occur if the community sources cannot me*et al*l of the site visitor's demands. A community that helps QoS have to actively manipulate useful resource allocation to fulfill various customers' and programs' needs. without appropriate aid allocation, network overall performance and carrier great go to pot unexpectedly underneath heavy load due to dropped packets and congestion. There are two most important architectural processes to useful resource allocation within the internet: included offerings (IntServ) and Differentiated services (DiffServ). Other than IntServ and DiffServ, different QoS frameworks have also been proposed. We, however, attention most effective on the greater important QoS framework proposals, namely IntServ and DiffServ.

a) IntServ

IntServ plays consistent with-drift aid reservation for provider differentiation. IntServ presents offerings on a according to-float foundation where a drift is a packet stream with common supply cope with, destination deal with and port number. In IntServ, a packet scheduler is used to put into effect resource allocation to man or woman flows while helping prioritization. The IntServ scheduler can be used to provide delay bounds. The delay bounds may be deterministic or statistical—for deterministic bounds, isolation or determination of sources is required, at the same time as statistical bounds may be provided when statistical multiplexing is used. There are key IntServ abstractions, particularly reserved resources and general resources. inside the Reserved resource abstraction, the router have to recognize the quantity of re-resources currently reserved for on-going classes. the usual useful resource abstraction includes the capacities of the hyperlinks and the router buffers, respectively. An instance is call Setup wherein buffers are stored at the routers. these buffers make certain a selected quantity of bandwidth is allotted to the flows at each router .

b) DiffServ

DiffServ, then again, plays consistent with-class aid reservation for provider differentiation, and uses prioritization, multiple forwarding lessons, and side policing to categorize traffic into distinctive classes; and the traffic is treated consistent with its respective training. the threshold routers are answerable for the complicated operations in the network; at the same time as the center routers carry out simple and clean computations. The packet-coping with rule in DiffServ is termed as consistent with-Hop Behavior (PHB). In other phrases, each network device alongside a direction behaves in a certain manner in which a particular institution of packets have the equal precedence fee. The PHB rule decides whether or not a packet needs to be forwarded or dropped depending at the QoS-based precedence value of the packet. But, the framework may be very complicated and cannot be implemented to heterogeneous networks. DiffServ has been used for enforcing QoS in diverse IEEE 802.11-based wireless networks which include.

2. Service Differentiation

Service differentiation is used to guide multiple offerings with diverse necessities—which include interactive delay-touchy services along with elastic put off-tolerant record switch services. The over provisioning of community resources is not always viable in radio networks, thus making service differentiation an vital thing of most QoS-based answers. In provider differentiation, several parameters (e.g., packet closing date) can be modified to define how a waft ought to get entry to the wireless medium. A ramification of offerings may be provided with the aid of using simple community parameters deployed in community nodes, and those offerings may be classified in step with a large variety of traits . The QoS of the gadget is superior by way of differentiating the priority of each host and offering them extraordinary tiers of QoS parameters. Provider requirements are regularly application-unique. as an example, sure applications are put off-sensitive (e.g., voice conferencing that's sensitive to round-journey postpone), at the same time as others are concerned greater with average transmission rate (e.g., bulk file switch). Provider necessities are regularly expressed the use of metrics Bandwidth, Postpone, Jitter and Loss price.

A extra comprehensive, but nevertheless non-exhaustive, listing of QoS metrics is displayed in parent 1. to deal with the impact of those metrics, the community ought to assist multiple QoS strategies to guide distinctive packages. The bandwidth necessities of different packages are exclusive. a few packages, including electronic mail, remote login and audio, require much less bandwidth, while video and file transfers require excessive bandwidth. in addition, the delay necessities also differ with the kind of software. some packages, which includes e-mail, are not postpone-sensitive.

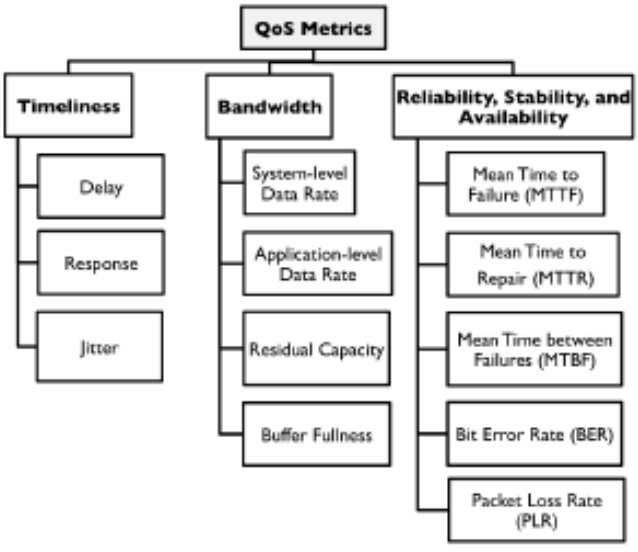

Fig.2. Taxonomy of QoS metrics

However, interactive packages, such as web browsing, videoconferencing and stay streaming, have extra stringent put off requirements. The variation in the packet arrival time inside a circulate of packets is referred to as jitter. e-mail, report sharing and faraway login aren't suffering from jitters inside

the community site visitors; while real-time appli-cations, audio and video do. The lack of packets within the case of audio and video isn't of significance. The alternative programs, as mentioned previously, cannot tolerate an elevated packet loss price in transmissions. On this paintings, we are able to consciousness totally on the QoS parameters of postpone, throughput, and warranted bandwidth.

3. Admission manage

One way of helping QoS is through admission manage—wherein new periods are allowed onto the network best if enough sources are available to provide service to the brand new and current periods. The interest within the area of admission manipulate, has been driven by using the concept that regulation of incoming visitors flows prevents community congestion, and facilitates in ensuring QoS. Call Admission manipulate (CAC) is a visitors control device hired in public switched cellphone networks (PSTNs). The CAC scheme is simple to implement because of the homogeneous surroundings. But, the present networking surroundings of homogeneous community isn't always preserved. Subsequently, the admission manipulate characteristic is extra difficult in heterogeneous networks (e.g., joint WLANs and IP networks). A new flow request is admitted handiest if the ongoing flows aren't negatively affected. The commonplace parameters used for admission manage are peak bandwidth requirement and the common charge. Consequently, the undertaking of admission manage is to maximize useful resource utilization in the community, and to control the quantity of visitors to acquire the predefined performance objectives of the current flows. Hou *et al*. have supplied a proper concept of QoS provisioning in unreliable wireless networks, such as the IEEE 802.11-based Wi-Fi networks, which subsumes a framework for collectively addressing three important QoS standards, specifically put off, delivery ratio, and channel reliability. they also endorse algorithms and guidelines for admission manage and scheduling that can be implemented in IEEE 802.11-based totally networks. The authors analytically broaden vital and enough situations to fulfill those three standards. Greater info of admission control strategies inside the context of IEEE 802.11 popular are described later in phase IV.

4. Congestion control

Congestion control in the present day net is typically done the usage of the TCP protocol. Congestion in a community can also occur if the quantity of packets dispatched to the community is extra than the number of packets a network can take care of. Congestion manipulate refers back to the techniques to control the congestion level and maintain the weight under the ability. Inside the QoS-included services, the congestion manipulates mechanism must be special for different kinds of assets: e.g., document switch/ email isn't the same as actual-time voice/video programs. The QoS enabled routers offer offerings to certain flows based totally on their requirements. Congestion manipulate allows to provide priority differentiation of flows by servicing queues in unique manners (e.g., the order in which the flows are serviced).

5. Scheduling

Scheduling is the key to proportion network sources fairly among customers in a community, and it provides carrier guarantees to time-important applications. The scheduler first makes a decision the order of requests to be served, and then it manages the queues of these awaiting requests. The scheduling scheme is essential for the networks due to the fact there are kinds of packages. One is insensitive to the performance that users obtain from the community, and the alternative has a strict bound at the overall performance. The scheduling can offer distinctive services to the flows using parameters such as specific bandwidths—by means of serving simplest a unmarried glide at a selected c programming language; exclusive suggest delays—in keeping with the extent of precedence described for the drift; and special loss prices—by assigning greater or fewer buffers to the flows . The scheduling mechanism followed inside the IEEE 802.eleven well known is defined in element later in segment III-C.

Literature Survey

Peng, Yuhuai, *et al.* (2013) In this paper, with the emerging of video, voice over IP (VoIP) and other real-time multimedia services, more and more people pay attention to quality of service (QoS) issues in terms of the bandwidth, delay and jitter, etc. As one effective way of broadband wireless access, it has become imperative for wireless mesh networks (WMNs) to provide QoS guarantee. Existing works mostly modify QoS architecture dedicated for ad hoc or sensor networks, and focus on single radio and single channel case. Meanwhile, they study the QoS routing or MAC protocol from view of isolated layer. In this paper, we propose a novel cross-layer QoS-aware routing protocol on OLSR (CLQ-OLSR) to support real-time multimedia communication by efficiently exploiting multi-radio and multi-channel method. By constructing multi-layer virtual logical mapping over physical topology, we implement two sets of routing mechanisms, physical modified OLSR protocol (M-OLSR) and logical routing, to accommodate network traffic. The proposed CLQ-OLSR is based on a distributed bandwidth estimation scheme, implemented at each node for estimating the available bandwidth on each associated channel. By piggybacking the bandwidth information in HELLO and topology control (TC) messages, each node disseminates information of topology and available bandwidth to other nodes in the whole network in an efficient way. From topology and bandwidth information, the optimized path can be identified. Finally, we conduct extensive simulation to verify the performance of CLQ-OLSR in different scenarios on QualNet platform. The results demonstrate that our proposed CLQ-OLSR outperforms single radio OLSR, multi-radio OLSR and OLSR with differentiated services (DiffServ) in terms of network aggregate throughput, end-to-end packet delivery ratio, delay and delay jitter with reasonable message overheads and hardware costs. In particular, the network aggregate throughput for CLQ-OLSR can almost be improved by 300% compared with the single radio case.

Kosek-Szott, Katarzyna, *et al.* (2013) In this paper, two amendments to IEEE 802.11 have recently been published: 802.11aa and 802.11ae. Both enhance Quality of Service (QoS) provisioning in Wi-Fi networks by providing support for multicast transmission, enhanced audio video streaming, coping with inter-network interference, and improved prioritization of management frames. The proposed solutions either extend mechanisms already existing in the standard or introduce new ones. Therefore, it is important for researchers to understand the new functionalities. To this end we provide the first description of these latest mechanisms: we present the motivation behind them, explain their design principles,

provide examples of usage, and comment on compatibility issues. Finally, we identify new research challenges related to the two new amendments.

Touil, Hicham, *et al.* (2014) In this paper, wireless Multimedia Sensor Networks (WMSN) incorporate multimedia sensors, and can combine them with scalar sensors. Also, WMSN usually exchange heterogeneous traffic which need different Quality of Service (QoS) levels. In addition, WMSN Applications (such as real-time audio-visual applications) engender an increased demand on Traffic-QoS (Throughput, delay, etc.). For these reasons, the development of a MAC protocol for WMSN able to ensure a high Traffic-QoS level over energy constrained constitutes a real challenge. In this paper, we propose a new generation of MAC protocols for WMSN, based on the IEEE 802.11e standard. More exactly, we study the feasibility of using MAC protocols of IEEE 802.11e Contention-Based in WMSN, and adaptations to be made to these protocols, to ensure suitable adaptation and an effective use. Through this study, we have validated the feasibility of our proposal in terms of Energy-efficient, Traffic-QoS and implementation complexity. As well, we have shown that our proposal is very evolutionist and ensures a high QoS-level.

Blanes, Javier Silvestre *et al.* (2015) In this paper, in spite of their limitations, wireless networks are being increasingly used in industrial environments. The electromagnetic phenomena that can occur, along with the interference that may occur due to it being an open medium, mean that fluctuations in latencies are often produced. These drawbacks limit the use of wireless networks for distributed factory applications where timeliness is essential. Recent standards, such as 802.11n, offer some interesting characteristics applicable to factory automation. In particular, QoS support and a very high data rate aids their operation under non-saturation conditions, allowing their satisfactory use as an industrial network. In this paper, the potential of these networks is analyzed in a real world scenario and their performance is compared with an idealized scenario. In both cases the priorities behave as expected, however, the algorithms for an auto-rate functioning perform badly in real world situations, especially in industrial scenarios such as those analyzed here, where the mobility of sources and the interference produced by other sources produce frequent rate changes, leading to a reduction in network performance.

Kaippallimalil *et al.* (2015) in this paper, this document provides guidelines for achieving end-to-end Quality of Service (QoS) in a Proxy Mobile IPv6 (PMIPv6) domain where the access network is based on IEEE 802.11. RFC 7222 describes QoS negotiation between a Mobile Access Gateway (MAG) and Local Mobility Anchor (LMA) in a PMIPv6 mobility domain. The negotiated QoS parameters can be used for QoS policing and marking of packets to enforce QoS differentiation on the path between the MAG and LMA. IEEE 802.11 and Wi-Fi Multimedia - Admission Control (WMM-AC) describe methods for QoS negotiation between a Wi-Fi Station (MN in PMIPv6 terminology) and an Access Point. This document provides a mapping between the above two sets of QoS procedures and the associated QoS parameters. This document is intended to be used as a companion document to RFC 7222 to enable implementation of end-to-end QoS.

Malik, Aqsa *et al.* (2015) In this paper, apart from mobile cellular networks, IEEE 802.11-based wireless local area networks (WLANs) represent the most widely deployed wireless networking technology. With the migration of critical applications onto data networks, and the emergence of multimedia applications such as digital audio/video and multimedia games, the success of IEEE 802.11 depends critically on its ability to provide Quality of Service (QoS). A lot of research has focused on equipping IEEE 802.11 WLANs with features to support QoS. In this survey, we provide an overview of these techniques. We discuss the QoS features incorporated by the IEEE 802.11 standard at both physical (PHY) and Media Access Control (MAC) layers, as well as other higher-layer proposals. We also focus on how the new architectural developments of software-defined networking (SDN) and cloud networking can be used to facilitate QoS provisioning in IEEE 802.11-based networks. We conclude this paper by identifying some open research issues for future consideration.

Shannon, Jonathan *et al.* (2016) In this paper, Time synchronization plays a critical role in time-sensitive distributed applications. While a variety of such applications exist across many domains, one particular set of applications where improved time synchronization can lead to significant benefits, particularly with respect to QoE (Quality of Experience), is multimedia applications. While time synchronization is not a new challenge, advances in wireless technologies have drastically transformed network infrastructures. 802.11 wireless networks increasingly represent the last hop within the ever expanding Internet and whilst users expect the same levels of multimedia QoE as exist over wired networks, the reality of moving back to contention based access leaves many disappointed. This transformation of networks has also proven problematic for time synchronization protocols that were designed for wired infrastructures. Wireless networks, particularly contention based networks, can be the source of very significant non-deterministic packet latencies. In certain scenarios, such latencies can greatly degrade the performance of time synchronization. This work details and validates a technique that can be used to determine the latency of time messages in real-time as they traverse an 802.11 wireless link. Knowledge of these latencies can be used to greatly reduce the error in a dataset employed by time synchronization protocols such as NTP and, thus, improve their performance. Experimental results confirm error reductions of up to 90% in a dataset and prove that the use of this technique can deliver time accuracies akin to those achievable over wired networks. This in turn can greatly benefit users by enabling multimedia applications to benefit from the continued use of time synchronization for QoE management. We outline two such scenarios, one where time synchronization is used to priorities VoIP traffic within an Access Point and a second where the aim is to use time synchronization to optimize jitter buffer strategies for WebRTC.

Chang, Che-Yu, *et al.* (2016) In this paper, IEEE 802.11p Wireless Access in the Vehicular Environment (WAVE) has been serving as the de facto wireless protocol for a Vehicular Ad hoc Network (VANET) with the explosive growth of vehicular applications. These applications require guaranteed Quality-of-Service (QoS). However, the fundamental channel access mechanism of WAVE, Enhanced Distributed Channel Access (EDCA), is not able to provide guaranteed QoS due to the unpredictable random access. To remedy this problem, we propose a novel channel access scheme, called Earliest

Deadline First based Carrier Sense Multiple Access (EDF-CSMA). EDF-CSMA based on EDCA dynamically adjusts the priority of real-time streaming to avoid collision and introduces an admission control policy according to time constraints to provide guaranteed QoS in multi-channel environments. An analytical model is carried out to study and compare the channel utilization of EDF-CSMA and QoS-aware Hybrid Coordination Function (HCF) controlled channel access (HCCA) method. The result shows that 60 percent of channel utilization is improved by EDF-CSMA. Additionally, real video-based simulations are conducted to evaluate the performance of EDF-CSMA and the existing EDCA method. The results show that EDF-CSMA reaches better QoS support than EDCA while maintaining efficient channel utilization.

Khorov, Evgeny *et al.* (2016) In this paper, wireless networks are replacing cables not only when providing Internet access, but also in such scenarios as multimedia transmission and high performance computing, which require extremely high data rates. Although millimetre waves open the door for multigigabit communications at the PHY layer, these rates do not guarantee an adequate Quality of Service (QoS) at the application layer. In order to improve QoS when serving multimedia flows in an IEEE 802.11ad network, a station (STA) can reserve a sequence of time intervals by means of a new reservation-based channel access mechanism. However, the IEEE 802.11ad amendment provides no recommendation on choosing such positions and durations of the reserved intervals which guarantee required QoS. This problem is significantly complicated by the erroneous nature of wireless channels so that the amount of the reserved channel time should account for possible retransmissions. To solve the problem, we develop a mathematical model of multimedia flow transmission with reserved time intervals over an erroneous channel in an IEEE 802.11ad network. We use the model as a basis for a scheduling method which allocates time intervals in such a way that the QoS requirements of the flow are satisfied with the minimum channel time consumption.

Pathan, Hussain Basha *et al.* (2017) In this paper, objective: The main objective of our research is to improve the QoS in Media Access Control (MAC) and Physical (PHY) layer and to provide more deterministic network performance so that data's that were transferred by the network nodes could in a better quality and network resources could be utilized effectively. Methods/ Statistical Analysis: The performance of QoS of IEEE 802.11 in MAC and PHY layer are studied using an enhanced opportunistic auto rate protocol e-OAR. The proposed algorithm uses distributed protocol for access control. This works by providing delay to the packets to increase efficiency of output. By allocating nodes in the basis, strength and efficiency of nodes will increase transmission efficiency by the help of e-OAR. Findings: The main function of MAC layer is secure packet delivery, access control and security in a network. PHY layer in IEEE802.11 standard describes two forms of spread spectrum modulation. The enhancement required in order to get a good QoS is by minimizing the time delay in transfer of data in physical nodes as the nodes are made of physical parts loss less transmission. For the competent use of a multi-rate physical layer, an e-OAR might be used which is very close to MAC layer. Absolute QoS guarantees is critical to provide, the relative QoS guarantees may be equipped by differentiation services. But, to provide characterized services, 802.11 protocols needs to be altered and it introduces three means for modifying DCF performance of 802.11 for assisting the differentiation of service. It decreases packet delay for improving performance of the system. Applications/Improvements: The QoS of IEEE 802.11 in MAC and PHY layer for improving throughput and packet delay of channel by using an e-OAR performance is interpreted in this study. The relative proposal guarantees are achieved using service differentiation DCF.

Network LAYER QOS answers FOR IEEE 802.11

The bulk of studies investigating QoS answers for the community layer of IEEE 802.eleven networks has focused on admission manipulate and QoS routing. these vital facets of network layer QoS solutions are discussed next in separate subsections.

A. Admission manipulate

Although the enhancements defined on the MAC layer presents service differentiation among unique site visitors flows, it could make sure QoS best whilst network load is reasonable. If the load will increase beyond a certain restrict, the QoS ensures aren't ensured even to excessive priority traffic. This is where the admission manage mechanism enables in stopping the community from turning into congested, by means of allowing or disallowing flows relying on whether or not the conditions are favorable to meet QoS necessities. Greater particularly, the reason of admission control is to restrict the quantity of newly admitted visitors such that the QoS performance of existing flows is not degraded. Admission manipulate is a key compo-net to adapt to the visitors variations consistent with the converting surroundings of IEEE 802.eleven-primarily based Wi-Finetworks. In, Hanson *et al*. has presented a very comprehensive survey on distinct admission control schemes to be had within the literature. Admission control may be categorized into 3 extraordinary methodologies.

1)Dimension-based Admission manage

In this scheme, the choices are made via continuous monitoring of net-work status, inclusive of throughput and delay. A positive threshold is maintained in keeping with the community reputation for admission of latest visitorsflows. Nor *et al*. in proposed a metric called network utilization function (NUC) as a method for admission of site visitors flows into community. NUC defines the quantity of channel applied to transmit the float over the community. This scheme guarantees QoS to high precedence flows below loaded channel environments. every other scheme offered by Wu *et al*. in is that every site visitors elegance is assigned a positive part of to be had resources, and these sources are then final reserved for that precise elegance. on this regard, only the visitors with better precedence in comparison to the existing site visitors is admitted.

2)Version-based Admission manage

In model-primarily based schemes, the community status is measured primarily based on a few models. The Markov chain models are pretty popular in tries at modeling IEEE 802.eleven even though other approaches are also being explored because of a few barriers of Markovianfashions. In, an analytical model is used to estimate the minimal bandwidth requirement of all

flows. while a newly admitted go with the flow need to be activated, the algorithm assessments if it is going to result in upkeep of QoS necessities of present flows.

3) Size-aided, version-primarily based Admission manipulate

It's far a hybrid of measurement-based and version-based schemes. The algorithm in takes network measurements in a loaded environment and additionally the information fee requirements of the float this is soliciting for admission. Moreover, a channel version is carried out to expect the network situations and gives QoS upgrades as a consequence. Some other answer is the threshold-based totally technique proposed in which the channel situations are constantly monitored and the rivalry chance is measured.

Conclusion and Future Work

The formerly described go-layer optimized Wi-Fi multimedia paradigm is best recently emerging and a diffusion of research topics nevertheless want to be addressed. sensible incorporated fashions for the postpone, multimedia quality, and consumed power of numerous transmission strategies/ protocols want to be evolved. Furthermore, the blessings in terms of multimedia exceptional of employing a pass-layer optimized framework for specific multimedia packages with exceptional postpone sensitivities and loss tolerances nevertheless need to be quantified. We've additionally recognized a new paradigm for Wi-Fi multimedia transmission primarily based on competition, which can bring about improved usage of Wi-Fi resources as well as more advantageous multimedia performance at participating stations.

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