An accommodative cross-layer design to boost QoS provisioning in MANET

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Abstract

Video transmission and spilling is one of the significant errands of Mobile Ad-Hoc arranges. As the innovation is developing the interest of sight and sound application is additionally developing which requires high information rate transmissions, less use of assets, limited start to finish delay. For versatile specially appointed systems it is hard to keep up every one of the requirements for better client experience because of the dynamic idea of system topology which causes the low quality of Service (QoS) for clients. To beat the issue of the QoS in MANET we propose a cross-layer plan innovation to improve the general execution of the Mobile Ad-Hoc Network. The proposed cross-layer configuration streamlines the video transmission rate, start to finish postponement and asset usage for improved execution of MANET. The proposed calculation demonstrates the less obstruction by using range detecting and sharing strategy. Recreation results demonstrate that the proposed calculation is a proficient technique to improve the QoS as far as by and large throughput of the system.

Watchwords—MANET, QoS, throughput, Cross-layer

Introduction:

As of late remote correspondence has developed its significance for different mixed media applications. This expands utilization of remote Ad-Hoc system and Mobile Ad-Hoc organize (MANET) for interactive media application. MANET is a sort of remote system which contains self-configurable versatile hubs and every one of the hubs can impart to one another without depending on framework of the system [1]. Increment in the interest of the remote correspondence in portable Ad-Hoc network(MANET) faces different difficulties as lower productivity of range, blockage on the imparting hubs because of traffic, less power proficiency ,dynamic nature of the versatile hubs and the obstruction by the clients which influences the presentation of remote correspondence framework as far as QoS (Quality of administration) [2]. QoS is seen as far as sign to-impedance and clamor proportion, bit blunder rate or blackout likelihood of the framework.

Range detecting is another parameter to influence the QoS (Quality of administration) of the system when there is no strategy is connected for the range detecting and sharing. In this situation all the versatile hubs attempt to get to the accessible range in an arbitrary manner due this the impedance is produced in the transmitted information which cause the lower QoS. Similarly, the dynamic idea of portable hubs in the MANET presents impedance in the cells of the system. Since media transmission in MANETs is a continuous application. Due to these issues in wireless Ad-Hoc networks or MANETs, it becomes a challenging task to improve the quality of service. Other than interference the varied encoding rates of the videos and transmission model leads to end-to-end delay and excessive resource utilization of the network thus degrades the quality of service and performance of the network [3].

To overcome these issues cross-layer architecture has been proposed which helps to improve the overall performance of the MANET. Design of cross-layer is an optimized process which allows network layers to exchange the information to obtain the improved performance. In this scenario there is a need to develop a scheme for adapting the transmission rates. The design of cross layer is able handle the rates of video transmission in wireless networks. According to the conditions of the network the rate of transmission of data should be adapted automatically without creating any congestion in the network. Keeping this in mind, to improve the performance of the model, feedback-free rate adaptation scheme is proposed by Z. Chen et al. [4]. This results delay and congestion in the network. Abrougui et al [5] proposed an effective scheme for the adaption of transmission rates. The key point of this scheme is that it doesn't require any feedback mechanism and provides the enhanced network resource utilization. In this work transmission rate of the particular node was computed using a routing algorithm.

Another way to improve the QoS of the MANET system is monitoring the nodes according to the specific requirements of the network. In wireless Ad-Hoc Network scenario, requirements of the network vary based on the location of the nodes. A link validation method is proposed to determine the requirements of the network [6].

Gesualdo Scutari et al [7] proposed a new approach for the improvement in QoS by using game theory approach. This is used to make the decisions for the sensing of spectrum which reduces the packet loss during communication.

A. Issues and challenges

The For any communication system there are some parameters to be achieved efficiently to show the performance of the system. These parameters are packet loss, power consumption, bandwidth, delay etc. The aim of the QoS improvement is to enhance the network performance and better utilization of the resources. For real time application MANET is significant for sight and sound transmission yet it faces a few difficulties when goes to the presentation as we have talked about in before segment.

The principle necessities for the QoS improvement are:

Limited overhead – Computational assets, limit parameters and power assets are constrained in the remote Ad-Hoc Network so minimization of the computational overhead and asset use is the key point for QoS provisioning in remote impromptu system.

Hearty engineering – As we have talked about that hub organization in the MANET is dynamical in the nature which causes disappointment and impedance because of the regular change in the system so there is a need to structure a versatile system model.

Decency – Resource sharing is additionally one of the difficulties in the MANET which improves the reasonableness of the framework. To conquer this, a range detecting and range sharing system should be joined with the versatility to extemporize the QoS.

The rest of this paper is sorted out as pursues. Area 2 displays the framework model, and Section 3 depicts the outcomes accomplished and Section 4 gives ends.

II. SYSTEM MODEL

Here In this segment we present the framework design to upgrade the nature of administration (QoS). We consider a versatile Ad-Hoc arrange, which contains the dynamic relating sessions and a solitary jump course. This kind of system can be utilized for the different correspondence situations in multi-cell systems when recurrence sharing is required for video transmission. In each session of the correspondence , the source hubs and goal hubs are recognized for the correspondence. Remote range of the system is partitioned into a lot of recurrence for symmetrical channels and these symmetrical channels can be shared among different sessions of correspondence.

In our proposed model we consider video edges to be transmitted over versatile specially appointed system and the season of transmission is separated into spaces for better assessment. In each vacancy, every session looks for the best channel dependent on the best channel recurrence. After determination of the channel, the proposed model adjusts the transmission strategy for example session chooses whether information to be transmitted dependent on the increase of channel or limit . At this stage in the event that addition of the channel is higher than ,, at that point transmission of bundles happens else it is put away to cradle memory for retransmission. For calculation of the limit information encoding rate and states of the connection channel are viewed as together which is depicted in the accompanying examination.

Parcel misfortune in the video transmission happens because of blunder in the transmission connection or termination of bundle defer limit. On the off chance that the transmission is unnecessary in the system, at that point the interest of productive channel builds which results the lower mistake rate in the transmission and the postpone incited because of support memory is additionally decreased. On other hand, on the off chance that transmission is low, at that point the mistake rate of the system increments and postponement decreases. As we have talked about, encoding rate likewise have some effect on the postpone requirement. Along these lines, a system is required which can encode the video at various rates and it can progressively adjust the states of the system by utilizing cross-layer design.

Fig. 1 portrays the framework model of the proposed cross-layer conspire. So as to portray the cross-layer conspire, the correspondence models at various layers will be presented as pursues. The proposed cross-layer model is given in fig 1. Above all else remote channel is presented then obstruction model lastly the transmission model is introduced.

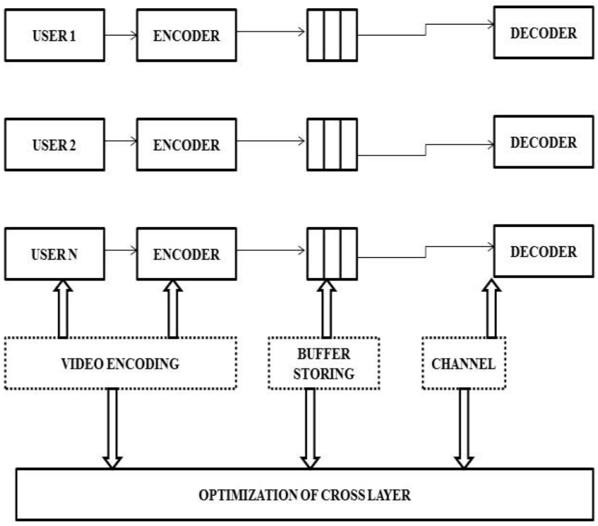

Fig. 1. Cross-layer model

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A. *Channel Modeling*

Video packets are transmitted based on the probability which can be computed by using a channel model applied at physical layer. In the channel it is assumed that it suffers from the path loss and channel fading. The channel model considered in this work suffers from both the large scale path loss and the small scale Rayleigh fading. The distribution of fading in each session is considered identical. Let $g_n^{\mathbb{F}}$denotes the gain of the channel of the session n ∈ N between its transmitter and receiver on channelf϶ F, then $g_n^{\mathbb{F}}$ can be represented as Video packets are transmitted based on the probability which cang_n^f is channel fading gain

Since the path loss usually tends to be infinity with the singular path loss model when the transmitter-receiver distance tends to zero, a non-singular path loss model is considered in this paper. Then path loss gain can be denoted as

$$PL_{gain} = (1 + dist_n^{a})^{-1} \qquad (2)$$

$dist_n^a$ is the communication distance by considering path loss exponent a for n session

The fading varies when the time interval of communication varies else it remains constant. The probability distribution function of each channel can be computed as

$$Prob(g_n^f = \mathcal{A}) = \exp\left(-\frac{\mathcal{A}^2}{\delta}\right)\frac{2\mathcal{A}}{\delta}, \forall_n \epsilon\, N \qquad (3)$$

B. *Interference Modeling*

In this In our proposed model the transmission model and interference model can be developed based on the channel model. Interference is caused if only one channel is used for the continuous transmission.

Let us consider signal to interference –plus –noise ratio of session is denoted by β_n^f. The probability of transmission in terms of successful packets is denoted by

$$Prob(\beta_n^f = t_{Th}) = Prob\left(\frac{Tx_{Power.n}.\, gain_n^f}{l_n^2 + D_n^f(\gamma_{-n})} > t_{Th}\right) \qquad (4)$$

t_{Th} is the threshold value

$Tx_{Power.n}$ is the transmission power for each session.

$D_n^f(\gamma_{-n})$ is the interference between data and channels

l_n^2 is the power of noise (Gaussian).

C. *Cross Layer design*

Once In our model a discrete time based cross-layer architecture is considered. Let us consider a node $n \in N$ transmitting content D to its neighbor $i \in I$. In a time duration of -2 , total α frames are transmitted. The C_{t-1} frame consisting of C_{t-1}^r and C_{t-1}^q is transmitted at the $(t-1)^{th}$ time instance. In the proposed model the q frame is considered to consist of two sub-frames which are $q1$ and $q2$ i.e. $q =$

$q1 + q2$. The sub frames are constructed at the time of encoding the previous frame r and then transmitted to the MANET nodes. This method of adopting subframe enables the efficient reconstruction while transmitting the multimedia data.

The encoded frame $C_{1_t}^{q,e}$ is defined as

$$C_{1_t}^{q,e} = \left((1 - Ql_{Ql1})C_{t-1}^{r}\right) + \left(Ql_{Ql1} \times C_{t-1}^{r}\right) \quad (5)$$

$C_{1_t}^{q,e}$ denotes the encoded frame.

Ql_{Ql1} denotes the quality layer of network.

Physical layer conditions of the network are achieved by

Subframe decomposition is achieved by the C_{s2}. In the condition of distortion when $C_{s2} = 0$ then $q1 = r$ and $q2 = \emptyset$, at this point on physical layer is used for communication which shows the adaptability of the model and dynamic changes in the model. Based on the physical layer conditions C_{s2} and C_{s1} are achieved and transmission of multimedia data is done for Δt intervals.

II. PERFORMANCE METRICES

A. THROUGHPUT

Throughput of the proposed model is computed based on the total received data bytes in the given simulation time

$$AvgThroughput = \frac{Received\ databytes \times 8}{Total\ simulation\ time} \quad (7)$$

B. End to end delay

$$AvgThroughput = \frac{\sum_{packet\ i}^{N} received - Sent}{Total\ packets} \quad (8)$$

III. SIMULATION RESULT AND ANNALYSIS

The In this section, we show the simulation results of the proposed cross-layer design for video transmission. This model is simulated in MATLAB tool under varying conditions of the network as varied load, varied frames rate and various scenarios of mobility and the performance matrices are evaluated to show the feasibility and effectiveness of the system. Packet transmission rate is assigned as 4 video packets per second and size of packet is given as 512 bytes. For this simulation study 1000 X1000 square field is considered.

Simulation parameters are given in table 1

Speed (m/s)	5,10,20,30,50
Number of nodes	20

In this model speed plays important role for performance i.e. throughput, end to end delay. Speed varies from 5 m/s , 10 m/s and 50 m/s and number of nodes are considered as 20. Performance of the throughput decreases when the speed of the node is increased, it can be seen from fig 2. The performance of throughput is compared with the DSDV protocol. Proposed model shows the better throughput performance when compare to DSDV. In figure 2, performance of proposed model is compared with the existing DSDV model in terms of throughput. The throughput for these models is computed by using eq.(7).

Average throughput for this simulation scenario is 72.83 by using DSDV method , to increase the throughput we use proposed model, by utilizing this the average throughput is increased to 93.46.

Similarly we compare the delay performance for varied speed. End to end delay is computed by using equation (8). According to the simulation study, when speed increases, the delay also increases. By using DSDV model, average delay achieved is 32.9 ms and by using proposed system it is decreased to 32.16ms.

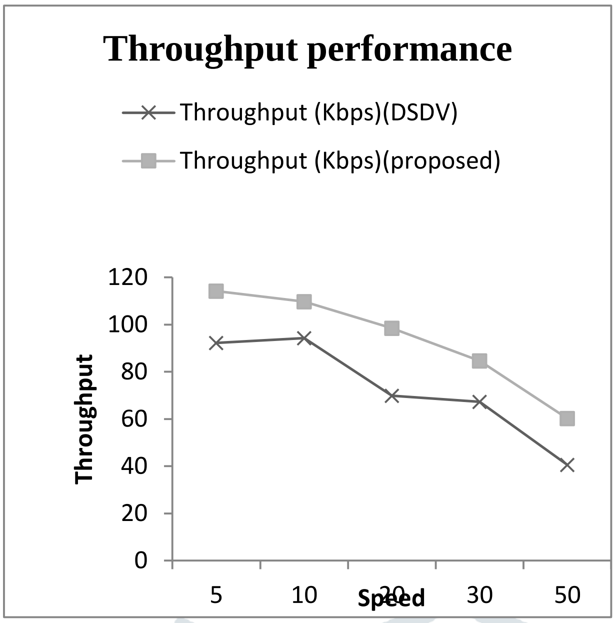

Fig.2. Throughput perforamnce

As the network size and speed on node increases, delay also increases due to the more waiting time to find the route for the transmission by using routing protocols. In fig 3 we show the delay performance of the proposed system with existing DSDV model.

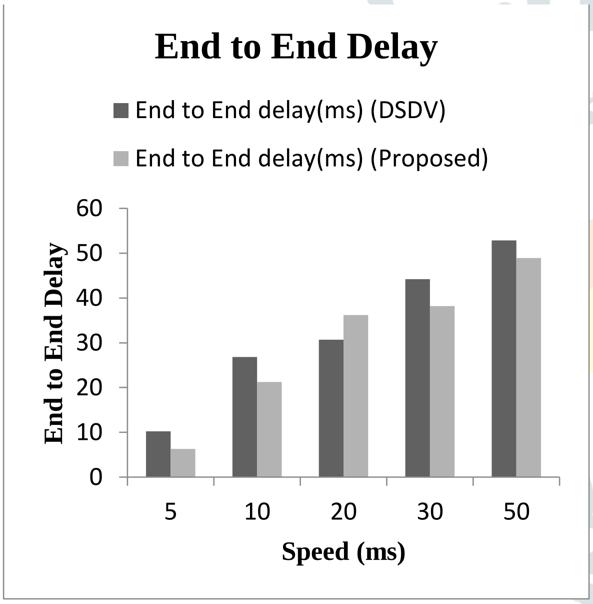

Fig.3.End to end delay performance

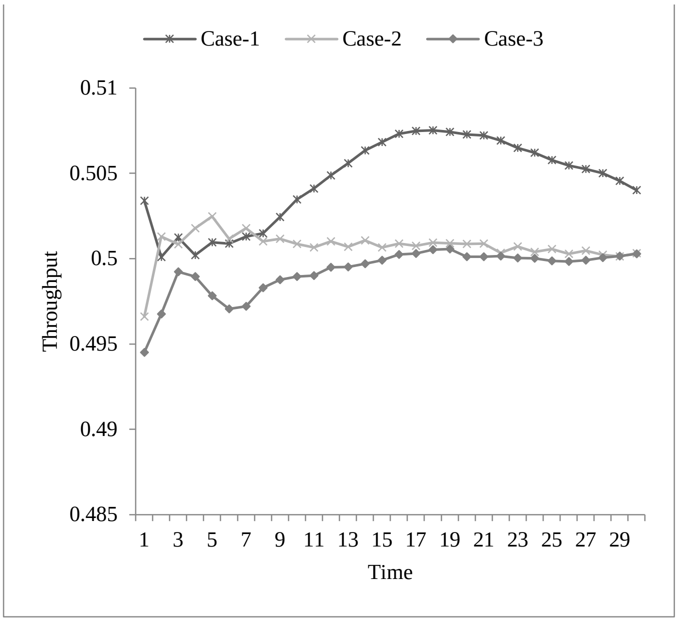

Fig. 4. Throughput vs time based on varied transition probability

V. CONCLUSION

In this paper, an efficient architecture for video transmission over interference affected mobile ad-hoc network is proposed by designing a cross-layer approach of transmission. In this scheme we compute the probability of transmission of a video data using proposed method. The performance of the system is computed in terms of throughput of the network. The proposed cross-layer scheme aims to maximize the average video quality of the whole network. The cross-layer optimization problem has been mathematically formulated and solved by a proposed layer specifier method which performance the selection of layer while transmitting. It improves the adaptability and dynamic configurability of proposed model. In addition, the numerical and simulation results showed the superiority of the proposed cross-layer scheme in terms of the network throughput.

VI. References

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