Mobility Management in Power Controlled and Rate Adaptive Ad Hoc Networks

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Abstract— **The dynamic establishment of node communication in a time varying interference channel imposes a major challenge in data delivery. The static transmission strategy followed by the sender with respect to the transmission rate and transmission power infuses significant concern in data propagation. Power Control and Rate Adaptation (PCRA) scheme, an approach that makes the adjustment of the parameters at the physical and application layer respectively to attain the required video quality. Achieving fairness among communicating nodes is also considered. Mobility issue of the wireless network needs attention in improvising video delivery. In this paper an algorithm developed in which parameter from the network layer has been used to discover link breakage scenario and provide suitable mechanisms to retain the path. The performance of the algorithm is evaluated on the metrics that includes delay, packet delivery ratio and overhead.**

Keywords*—: *Wireless Network, Static, Mobility, Power Control And Rate Adaptation, Link Breakage.

I. INTRODUCTION

Ad-hoc a decentralized form of wireless network, and does not rely on any infrastructure. Referred as on the fly networks, utilizes the multi -hop relay for data transmission. The network is self-configuring, dynamic and the nodes are free to move. The absence of the base station makes the routing complex. Under this situation, an intelligence mechanism is required to transmit and receive the data and also route the packets. There are several factors contributing to the work function of ad hoc network. The most important quality of service improvement factors are:

(i) Channel access scheme : The channel for communication is very limited and are to be to be efficiently used. Due to the presence of hidden, external node problem and collision of data packets that occur due to simultaneous propagation of nodes leads to loss of packets.

(ii) Access delay : The average delay experienced by the routers during packet transmission.

(iii) Throughput : Network throughput refers to the successful transmission of data passing through certain nodes in the network. Usually measured in bits per second or data packets per second or data packets per slot.

(iv) Fairness : Fairness defines the share of the resources among the demanding users. They are measured in terms of congestion, throughput, allocation of flow and the QoE (Quality of Experience).

(v) Routing: Routing refers to the transmission of data in the determined path. Various routing protocols assist in exchanging route information of the nodes to find the feasible path. The path is based on hop length, minimum power required for transmission. Mobility is the main factor to be considered, for the performance of the network may be affected if there is a break in link, collision and formation of loops.

(vi) Multi casting, quality of service, energy management are other factors to be considered.

Rate control for *ad hoc* networks has many challenging problems. The introduction of rate controlling algorithms and policies help in solving the probabilistic nature of wireless medium. The unified view of the medium also varies due to the physical differences between wired and wireless transmission.

Under varying conditions, achieving high performance requires the nodes to dynamically adapt their transmission rate. By dynamic adaption of rate improves the user experience on streaming, and also prevents the receiver from under flow, hence improvising the Quality of Service (QoS).

Sender or the receiver performs the rate adaptation, usually performed at the receptor. Auto Rate Fall back (ARF) is the first commercial rate control algorithm implemented in plain 802.11 network as per the requirements of the receptor. ARF works fine with plain wireless networks. The ARF was further enhanced to Adaptive ARF to improvise the rate control at the receiver's end.

Adaptive Auto Rate Fall back (AARF) was proposed to improve performance in stable environments. Unlike ARF keeping the rate increase threshold constant (N), ARRF adaptively adjusts this threshold. More specifically, a sender increases its data rate r_{old} to a new rate r_{new} after N consecutive successful transmissions.

If the first transmission at this new rate r_{new} fails, the sender falls back on the prior rate r_{old} and doubles the threshold to 2N for the next rate increase. Otherwise, i.e., the first transmission at the new rate succeeds, the threshold is reset. With such adaptive threshold updates, AARF increases the time interval between rate increases over a stable channel and produces fewer rate fluctuations than ARF.

The channel conditions are considered to achieve a higher rate by the adaptive ARF. If there are rapid changes in the channel conditions then there may not be an effective rate control by AARF. If the channel conditions never change or the change is very slow many probe attempts are required.

The threshold (number of successful transmissions to be seen to send a probe packet) values are updated dynamically. The Adaptive ARF can be efficiently implemented at the receptor's side with a cross framework architecture. The performance of the AARF is effective than the ARF under the varying conditions of the network.

II. RELATED WORK

In recent years, achieving Quality of Service (QoS) in wireless transmission is a huge challenge. A wide variety of literature exists in improvising the QoS. In [5], [10] an elaborate investigation on the QoS approach of streaming is presented. The Rate control and resource allocation in wireless network, subjected to various circumstances are addressed in [2] and [8].

In [6] briefs the various techniques to reach fair beaconing rate for traffic control in vehicular networks. Reinforcement learning is applied and that involves an agent that interacts with the environment with discrete time steps. A reinforcement problem is modelled as a Markov Decision Problem (MDP) and is solved by supervised learning and dynamic programming techniques as briefed in [7].

One of the major limitations observed in ad hoc networks is energy harvest because the nodes are usually battery operated. A variety of energy prediction models have been developed. The models proposed utilize the renewable sources of energy from the environment namely solar, airflow, vibration and radio frequency sources as discussed in [3].

Information centric networking, an approach to evolve the internet infrastructure to that kind of network framework where the important focus is the information. The challenges against content dispersion is considered in [9].

III. PROPOSED WORK

Cross-layer that refers to the manipulation of data from the lower three level layer in a distributed joint power control and rate adaptation frame work. It is very much essential in conditions wherein wireless network of multiple transmitter-receiver pairs that use the same bandwidth by interfering with each other.

In the case of network based on ad hoc or a device-to device network efficient use of power to the node with different time slot is very much useful. Further, the time diversity of the wireless channels, satisfies the hard delay constraints associated with video applications, and respects a certain fairness criterion among the nodes.

However these multiple nodes may demand the same video quality, whereas the bit rate they can support and the packet loss they experience may be different due to their different channel conditions.

In addition, the wireless radio resources are limited, and therefore, they should be efficiently shared among multiple streaming users. The issue of mobility in Power Control Rate Adaptation Scheme (PCRA) can be resolved by enhancing the PCRA scheme to LPCRA (Link breakage probability in PCRA). The LPCRA ensures the connectivity with increased power during high link breakage scenario that sustains the data delivery and avoids rediscovery of new path.

IV. MODULE DESCRIPTIONS

A. *CONCURRENT DATA TRANSMISSION*

Wireless networks involves multiple source and destination pairs. And the transmission among the nodes are simultaneous. The continuous data transmission leads to interference among the communicating nodes. The arrival rates are calculated for the packets transmitted and received.

B. FAIRNESS AND SATISFACTION CALCULATION

A controller is implemented at the sender to perform power control and admission control. At each node fairness is calculated based on the arrival rate. Every node performs the power and rate control based on the obtained fairness. Satisfaction parameter is calculated from the estimated fairness.

C. POWER AND PROPOGATION RATE ADJUSTMENT

Depending upon the target and instantaneous fairness of the corresponding receiver, a given target bit error rate criterion, and the maximum acceptable/feasible transmit power level, each video transmitter node solves the above control problem.
The transmitter node, thus, gets the desired value of the video rate (video quality), and the transmit power needed for video transmission at this rate.
The transmitter then transmits data to the corresponding receiver with the newly obtained transmit power and rate. Power allocation is done at the PHY layer and rate adaptation is done at the v upper layer.

D. MOBILITY CONSTRAINT POWER CONTROL

The mobility of the nodes leads to link failure, leading to packet loss during transmission. The power adjustment is made in a way to avoid the link breakage.
The hop count among the nodes are measured at each step and based on the distance the power is adjusted. If the link breakage probability measured is higher the node increases its power to communicate with long distance router in order to reduce data loss.

V. EXPERIMENTAL RESULTS

A comparative study between the existing and the proposed methods are made based on the evaluation parameters such as delay, overhead and packet delivery ratio. A simulation environment with multiple source and destination pairs are considered for evaluation.

1 .DELAY:

It is the time taken for the data to travel across the network from one end point to other node.
As we seen in the Fig5.1 it is observed that there is fall in delay. The reason attributed is the LPCRA method avoids the rediscovery of the new path and handles link failure.

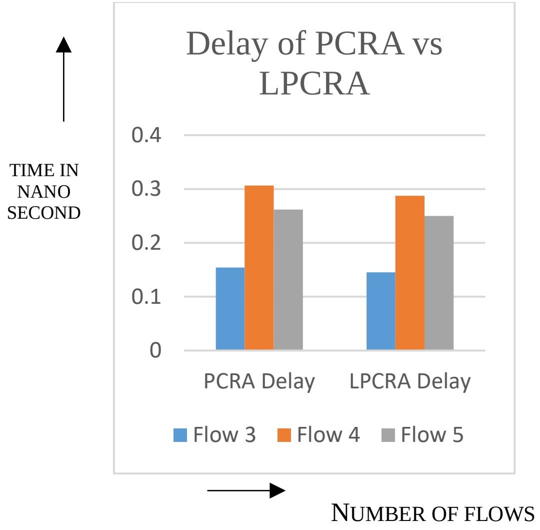

Fig5.1 Delay of PCRA vs LPCRA

2. OVERHEAD:

It is the transmission of non-data bits that includes headers and checksums from source to destination.

It is also evident the decrease in overhead as observed in Fig5.2 is attributed to retention of the same path for data transmission. During link breakage scenario the connectivity is improved with an increase in transmission power to communicate with the long distance router.

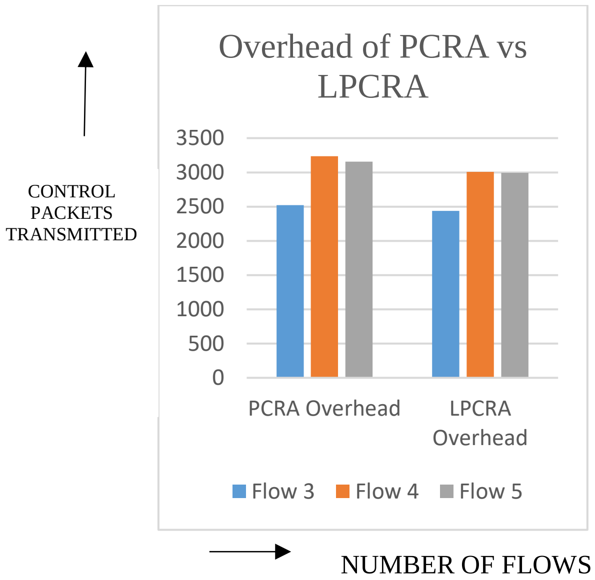

Fig5.2 Overhead of PCRA vs LPCRA

3. PACKET DELIVERY RATIO:

Packet delivery ratio is the ratio of received packets to the transmitted packet in the network.

The algorithm introduced measures the hop count among the intermediate routers at every step to avoid packet loss that occurs due to link failure. The increase in PDR is shown in Fig5.3.

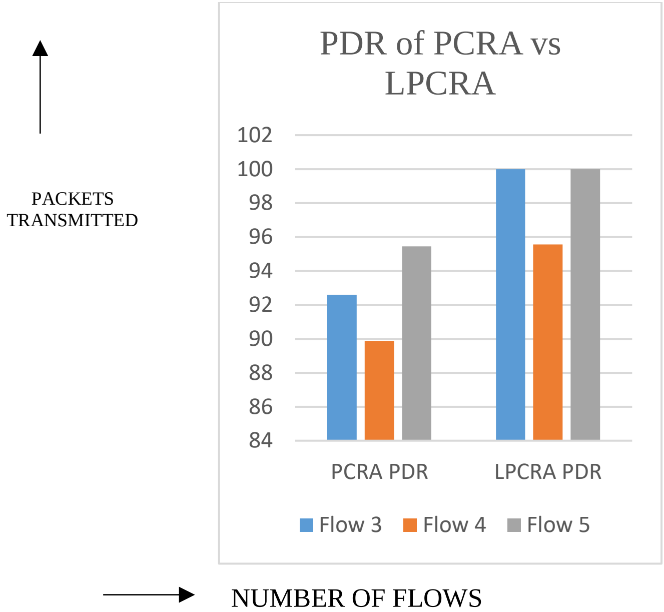

Fig5.3 Packet delivery ratio of PCRA vs LPCRA

VI.CONCLUSION

This paper presents an approach of LPCRA (Link Breakage probability in Power Control and Rate Adaptation) for the purpose of ensuring connectivity during link breakage scenario in the network. The performance analysis was investigated with the impact factors such as delay, packet delivery ratio and overhead. Simulation results show that the proposed method optimizes the QoS (Quality of Service) of the existing method.

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