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Framework for Splitting Algorithm of NCAC-MAC Protocol for collision Avoidance in Wireless Ad Hoc Network

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***Abstract*— Ad Hoc Network used in military and emergency rescue environment. Co-operative communication effective technique to deal with the channel fading and improve network performance, and provides higher throughput and reliability. Ad Hoc Networks can connect different wireless devices to enable more powerful wireless applications and mobile computing capabilities. Co-operative approach promises improved throughput and delay performance. This work, proposed a network coding aware utility based relay selection strategies, to choose the best relay in an efficient and distributed manner. Also, MAC protocol enables co-operative relay transmission. Focus on the MAC layer protocol design which is critical to reap the performance gains brought from the physical layer. Use of NCAC-MAC protocol in wireless ad hoc networks increases the throughput and reduces delay. For avoiding collision in the network used the splitting algorithm to solve that problem in NCAC-MAC protocol for large size network. Using increases the throughput and reduce the delay over each network.**

Keywords-Co-operative Communication, Medium Access Control, Network coding, Relay Selection.

I.INTRODUCTION

A wireless ad hoc network is formed by the group of nodes, in which a node can be sender, receiver or relay node. In the wireless network, one or two data packet is combined that are sent over the network to increases efficiency and diversity gain. Wireless channels are a difficult and capacity-limited broadcast communications medium in the network. Traffic patterns, user locations, and network conditions are constantly changing in the networks. Applications are heterogeneous with hard constraints that must be met by the network. Energy and delay constraints change design principles across all layers of the protocol stack.

In cooperative communication discuss the how the groups are supported and activated. In MANET network model transmission is at the centre will be activated and controlled by cluster access point (AP), and all terminals communicate and transfer data over the cluster using cluster AP. In cooperative network AP used multiple gateway nodes. Cooperative communication consider three element in which source that transmit the information, destination at which information received and relay that work both the receive and transmit data to increase communication between source and destination.

An energy-efficient class of cross layer network algorithms called cooperative diversity that exploit the broadcast nature and inherent spatial diversity of the channel. Cooperative diversity is a cooperative multiple antenna techniques which exploits user diversity by decoding the combined signal of the relayed signal and the direct signal in wireless multi-hop networks. Cooperation takes full advantage of the broadcast nature of the wireless channel and creates spatial diversity, thereby achieving tremendous improvement in system robustness, capacity, delay, a significant reduction in interference, and extension of coverage range.

In the transmission process relay node enable to retransmit data for source node, when deliver its separate data continuously, Hybrid Cooperation Network Coding (HCNC) [1]technique introduced to employ the network coding technique in cooperative transmission process and take advantages of the both network coding and cooperative communication, used reactive CMAC policy. Relay selection done by randomly and relay node assist other node and serve their own traffic, transmission process transmission failed at that time neighboring nodes retransmit data behalf of the source node. In HCNC technique coding technique not guaranteed, multirate capacity of the network does not exploited and reduce the overall delay all this issues on the network coding and cooperative communication on the MAC layer.

II. RELATED WORK

Dual Sensing Directional MAC protocol solves the hidden terminal problem and avoids unnecessary blocking [2] Spin tool is used for validation and verification. DSDMAC improve the throughput and delay performance. Cooperative MAC for wireless LANs used two types of nodes first is high data node and second is low data node. Coop Table store the list of helpers node that are used in assistance during transmission in each station maintain table by each low data node. Coop Table [9] creation and updating done by listening all running transmission. Same frequency band can be used for transmission and reception. Transmission via helper node is more time efficient than direct transmission. Single base station communicates with the multiple users using relay node in cellular network. Using [6] Cooperation achieve optimization framework to solve the problem of relay selection and power allocation. For combating multipath fading across the multiple protocol layers develop and analyze space time coded cooperative diversity protocol. . Amplify-forward and decode-forward algorithm will extended to combat multipath fading in large network [10].This algorithm used for improve bandwidth, gives full spatial diversity in the number of cooperative nodes.

CD-MAC [3] is Conventional protocol, cooperation done by intermediate node between sender and receiver. Evaluates system level performance. This protocol improve the robustness, does not require any frame format.MAC protocol developed for distributed network two issues mainly consider when to cooperate and whom to cooperate. Selecting relay node used optimal grouping strategy [5]. Performance trade-off between multi user diversity gains increases. For a small size network. Two relay based cooperative MAC (2rcMAC) [4] protocol, using two relay path gives the higher data rates. Relay node used for backup transmission in the network.

TABLE 1.COMPARISION OF MAC PROTOCOL

Cooperative MAC Protocol	**Network Scenario**	**Research objective**	**Cooperation Strategy**	**Relay Selection Scheme**
NCAC-MAC [1]	Small Size	Throughput	Network coding, Reactive	Contention, Backoff
CDMAC [3]	Multi-hop	Throughput	Space-time-coded,Proactive	Preselect,Historical Information
2rcMAC [4]	Small Size	Throughput	Repetition-based,Proactive	Contention,Mapping
CoopMAC [9]	WLAN	Throughput	Repetition-based,Proactive	Preselect,Historical Information

III.FRAMEWORK OF PROPOSED SYSTEM

A. Proposed Work

In wireless ad hoc network, Hybrid Cooperative Network Coding (HCNC) technique in this a relay node to retransmit the data for source node, while delivering its own data simultaneously. It is to employ the Network Coding (NC) technique into the cooperative transmission process and gain advantages of both NC and CC. Reactive CMAC policy Phoenix, which based on HCNC technique. In this, relay node can assist other nodes and serve their own traffics simultaneously during the retransmission process. Selection of relay node is random manner. At the time of direct transmission fails, the neighboring nodes sensing free medium at the end of random backoff time. Some drawback in Phoenix are given below,

- The coding opportunity is not guaranteed.
- The multirate capability of the network is not exploited.
- The packet queuing conditions at different relay candidates are not considered.

Considering all these issues develop a Novel Network Coding Aware Cooperative Medium Access Control (NCAC-MAC) protocol.

A novel Network Coding Aware Cooperative Medium Access Control (NCAC-MAC) protocol focuses on the MAC layer protocol design, which is critical to reap the performance gains brought from the physical layer. Increasing the throughput and reducing delay we propose novel HCNC-based reactive CMAC policy namely NCAC-MAC based on the IEEE 802.11 CSMA policy without channel negotiation for wireless ad hoc networks. The conventional Acknowledgement (ACK) frame and Negative ACK (NACK) frame a new control frame named Eager-To-Help (ETH) [1] is introduced in this schema to enable the efficient and distributed best relay selection.

B.System Architecture

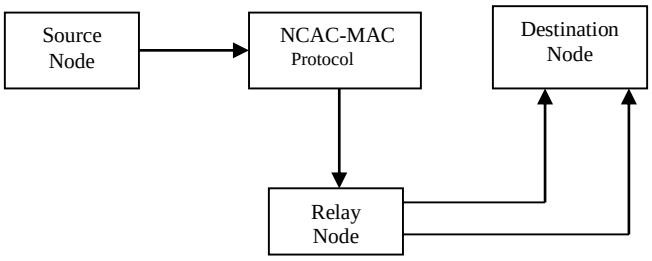

Fig.1 System Architecture

In above figure explain the system in the source node sends the data packet over NCAC-MAC protocol this protocol select best really for efficient transmission for that used Collision Free relay selection strategies.With the help of relay node data,packet sends over the destination node and after accepting data packet node send positive acknowledgement to the relay node otherwise send the negative acknowledgement.

To achieving the output create the network that contains numbers of nodes in which define the source node and destination node for transmitting the data over the network. Calculate all the in the network and find the minimum one for transmission. Selecting proper relay node for an intermediate node for transmission between sources to destination. When source node sending data to relay the node then relay send to the destination, receiving the data packet relay node receive the positive acknowledgement otherwise negative acknowledgement. After receiving the negative acknowledgement, retransmission process takes place at the relay node.

Network consist of the large number of nodes are present at the same time collision occurs to avoid this some collision-free relay selection strategies,

1) Group Contention-based Relay selection

In GC-RS each relay candidate contents for retransmitting through three contention periods that are intergroup contention, intragroup contention and recontention. Relay node enters into the intergroup contention receiving the NACK frame. The inter-groupcontention period can be divided into G groups. Each relay candidate calculates its group index g. Node with low group index is assigned a high priority to access the channel. If no Group Indicator (GI) is overheard from lower index groups, the nodes in group g send GIs and enter into intragroup contention period. In Intragroup, divide the intragroup contention period can be divided into M time slots. Each relay

node in the selected group g calculates its member index m. There are two possible outcomes after the intragroup contention ends. The first outcome is that single relay node sends MI (member indicator). In the case that there is only one node with group index g and member index m, the destination node sends out a feedback signals (FB1) equal to 1. Upon receiving FB1, the selected relay node broadcasts an ETH frame after SIFS, and performs the retransmission immediately. In the second case, two or more relay nodes send MIs in the same time slot; we employ a recontention period to randomly select a best relay node among the collided optimal relay nodes.

2) Splitting Algorithm-Based Relay Selection

In SA-RS only those relay nodes whose utility value lie between two thresholds transmit. The threshold is updated on every node independently round by round based on feedback from the destination node. At every time slot, each relay candidate checks its utility value. If it lies between the current two thresholds, the node broadcasts a Relay Indicator (RI), otherwise, it keeps silence. The relay candidate wait for the feedback from the destination node, when the current time slot ends. If no feedback is received, it means that no relay node sends RI at the current time slot.

Following steps gives way of Splitting Algorithm:

a) Definitions:

For best relay selection three variables are used that are H_L(k)-lower metric thresholds, H_H(k)-upper metric, thresholds,H_{min} (k), such that node i transmit at time slot k if satisfy the H_L(k) $<u_i<$ H_H(k).

b) Initialization:

In first slot (k=1) initialized parameter $H_L(1) = F_c^{-1}(P_e/n)$, $H_H(1)=\infty$, H_{min} (1) =0,P_e-is system parameter referred as Contention load parameter.

c) Transmission rule:

At the starting of each slot each node locally decides to transmit. It transmit if and only if its metric lies between H_L(k) and H_H(k).

d) Feedback generation:

At the end of each slot sink node broadcast to all nodes a two-bit feedback: 0-idle, 1-success,e-collision.

e) Response to feedback:

Define the split function

$$\text{Split (a,b)}=F_c^{-1}\left(\frac{F_{c(a)}+F_{c(b)}}{2}\right)$$

Following possibilities:

1) Feedback is idle and no collision then set,
H_H(k+1) = H_L(k), $H_L(k+1)=F_c^{-1}(\frac{k+1}{n}P_e)$,
H_{min} (k+1)=0.

2) If the feedback is a collision then set,
H_L(k+1)=split (H_L(k), H_H(k)), H_H(k+1) = H_H(k), $H_{min}(k+1)=H_L(k)$.

3) If the feedback is an idle and collision occurred in the past then set,
H_H(k+1) = H_L(k) , H_L(k+1)=split(H_L(k), H_H(k)),
H_{min} $(k+1)=H_{min}(k)$.

f) Termination:

Terminate algorithm when get success.

C) MATHEMATICAL MODEL:

At the time of transmission, once the backoff counter reaches to zero, the packet will be transmitted.There are four cases for transmission:

I.The payload is decoded successfully.
The destination node sends back ACK frame and source node handles next packet for sending.

II.The payload is corrupted,but the received SINR is above threshold $A_{th.}$

- When relay node receives NACK with SINR_FLAG equal to 1, then each relay candidate starts a utility based backoff to contend for the retransmission.
- Each realy candidate i calculate utility value for every packet y queuing in its buffer.

$$T_i^{NCS} = \frac{C}{U_i^{NCS}}$$

$$U_i^{NCS} = \min_{y=1,2,\ldots,Li}(P_{y.}(\beta.(Si.y/S^{max})+L_i / L^{max}))$$

T_i^{NCS}- backoff time of node i.
U_i^{NCS-} Utility value of the node i.
$L_{i.}$ Number of packet queuing in the buffer at node i.
L^{max}- Length of the buffer.
$S_{i,y}$- Estimated throughput for packet y.
S^{max}- Upper bound.
P_y(0<=P_y<=1)-Probabilityability.

$$S_{i,y}=\begin{cases} Si,j & D(y)=j \\ \min(Sij, SiD(y) & otherwise \end{cases}$$

Si,j= Pij Rij

Pij= Probability of success transmission.

Rij= Data rate.

$$Py=\begin{cases} 1 & D(y)=j \\ Phigh & C(source,D(y)) \geq C(source,relay). \\ Plow & otherwise \end{cases}$$

I.The payload is corrupted, and the received SINR is below the threshold $A_{th.}$

- Relay node received NACK with SINR_FLAG equal to 0.
- $T_i^P = C/Ui^P$

U_i^P= β.(Sij / S^{max}) + d^{min} / $d_{i.}$
di- Estimated delay at node i.
d^{min}- lower bound of estimated delay.

D)RESULT

Implementing proposed system get following comparision result between existing system and our proposed system that are given below,blue color for existing system and black color for proposed system.

First graph gives result for throughput increses using splitting algorithm.

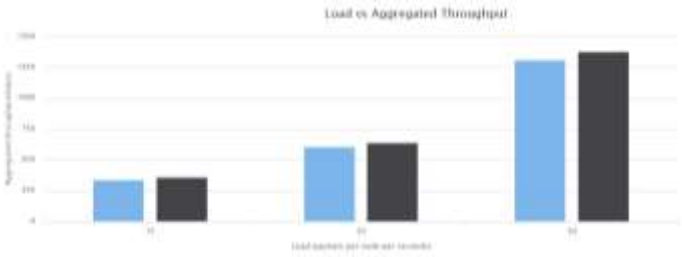

Fig.2 Load versus Aggregated throughput

Second graph gives result for Delay decreses that are shown below,

Fig.3 Load versus Delay

Third graph for energy consumption using this system in large size of network,

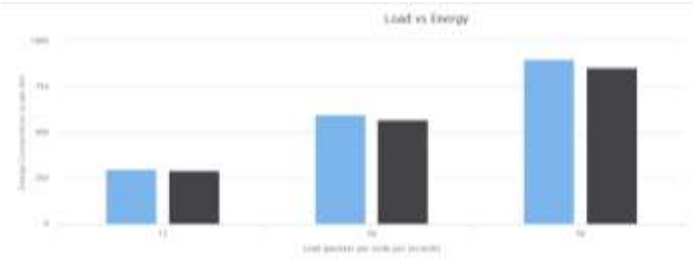

Fig.4Load versus Energy

The fourth graph is about packet delivery ration is also increases in the network,

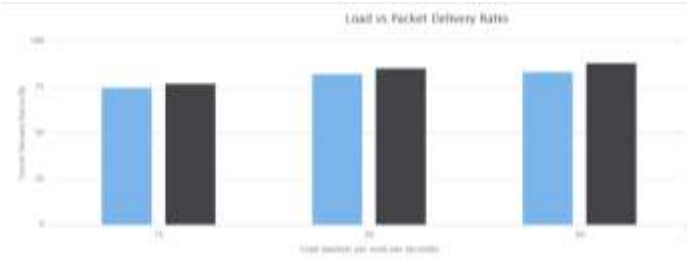

Fig.5 Load versus packet delivery ratio

IV.CONCLUSION

In wireless ad hoc network improve the communication link and performance NCAC-MAC protocol developed. It uses advantages of both NC and CC can be exploited. A network coding aware utility based relay selection strategy to select best relay in an efficient and distributed manner.To increase the network throughput and reduce delay. Group contention based relay selection and splitting algorithm based relay selection are the two collision-free strategies are used to improve throughput, efficiency and delay.

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