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Lifetime and Energy Maximization in MANET Using CMAC Protocol Design

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Abstract: *Mobile Ad-hoc NETwork (MANET) is a self configured network of mobile terminals connected by wireless links. The mobile terminals are battery powered, and energy is a scarce resource, issue with continuous participation in MANETs is the network lifetime. Cooperative Communication (CC), is that which utilizes nearby terminals to relay the overhearing information is a promising solution to improve the life time of the network. To enhance the spectral and power efficiency & lifetime of the network cooperative communications with relaying nodes are very effective. Relaying induce complicated medium access interactions, to handle these interactions and to capitalize the benefits of cooperation an efficient Cooperative MAC protocol is required .So here Distributed Energy-adaptive Location-based CMAC protocol, namely DEL-CMAC along with effective cross layer cooperative diversity approach for MANET has been proposed. Cross layer handles the interaction between higher layer and cooperative diversity is used for diversity gain in the network where relay nodes are used. In addition cooperative diversity is used to handle large scale network with high mobility. The use of cross layer cooperative diversity along with DEL-CMAC leads to increase in reliability in the network. The design objective of proposed work is to improve the network lifetime of MANET by reducing the power consumption and improving the throughput.*

Keywords: *MANET, DEL-CMAC, Cooperative Communication (CC), Relay terminals.*

1.Introduction

Mobile Ad-hoc NETwork (MANET) is typically referred as an infrastructure less network with mobile terminals connected by wireless links, each equipped with its own wireless transmitter and receiver. Mobile terminals such as cell phones, tablets, PDAs (Personal Digital Assistants) etc., have wireless networking capabilities. These wireless terminals on participating with MANET may reach the Internet even when they are not in the range of Wi-Fi access points or cellular base stations, or it can also communicate with each other when no networking infrastructure is available. Quick deployment and minimum configuration made MANET suitable for emergency situations such as automated battery fields, military conflicts and home applications. MANETs can also be utilized in the disaster rescue and recovery.

The issues in MANET are;

- One primary issue with the continuous participation of wireless terminals in MANET is the network lifetime, because these wireless terminals are battery powered and energy is a scarce resource.
- Due to communication environment, fading occurs in the signal and also surrounding nodes in the network causes interference. Fading and interference are the two major obstacles for obtaining best performance while delivering signals.

These critical problems can be solved by including cooperation among the nodes. The broadcast nature of the wireless medium is exploited in cooperative fashion. The wireless transmission between a pair of terminals can be processed at other terminals for performance gain, rather than being considered as interference traditionally. Cooperative Communication (CC) is a best technique for conserving the energy in MANETs & it can provide gain in terms of required transmitting power due to the spatial diversity achieved via user cooperation.

The proposed system contributions are summarized as follows;

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- In this paper, "Cross-layer Cooperative Diversity aware DEL- CMAC" is proposed that focuses on the network lifetime extension by considering the overheads and interference due to cooperation, as well as the energy consumption on both transceiver circuitry and transmit amplifier.
- A cross layer between PHY-MAC has been designed to conserve the energy while maintaining certain throughput level.
- Cooperative diversity is used to mitigate the impact of fading.
- Extensive simulation results reveal that cross-layer Cooperative Diversity aware DEL-CMAC can significantly extend the network lifetime at relatively low delay degradation, and improved throughput compared with DEL- CMAC and throughput aimed scheme Coop MAC.

2.Related Works

In [2] Cooperative MAC (CMAC) has been proposed by considering the practical aspect of CC and is named as CoopMAC. It has been developed to exploit multi-rate capability and aimed at mitigating throughput bottleneck caused by low data rate nodes. In [5] a reactive network coding aware CMAC protocol has been proposed, in which relay node can forward data to the destination but it failed to address the network lifetime. In [3] a distributed CMAC protocol has been proposed to improve the network lifetime which is impractical for most applications. In [1] the transmission channel is split into data and control channel and the data is transmitted when the busy tone is active. The disadvantage of this paper is that when a node is transmitting no other node in its two-hop neighborhood is permitted to transmit simultaneously. In [4] DEL-CMAC has been proposed to improve the network lifetime but high diversity gain is not achieved as they employed only single relay terminal.

3.The Proposed Cross–Layer Cooperative Diversity DEL- CMAC Protocol Description

The proposed cross-layer Cooperative Diversity aware DEL-CMAC has been based on the IEEE 802.11 Distributed Coordination Functions (DCF). The Frame exchanging process of the proposed model is shown in Figure: 1.

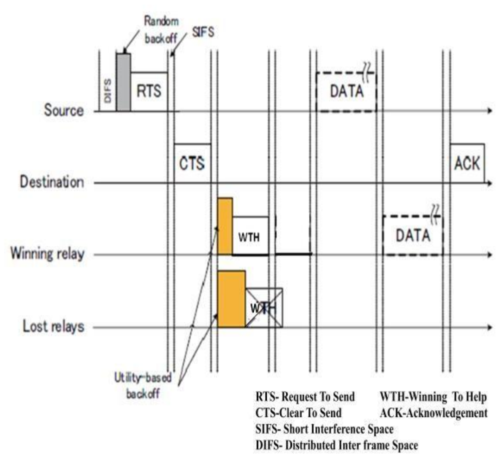

Figure: 1. Frame Exchange process of Cooperative Diversity DEL-CMAC protocol

3.1.Data Transmission

When a source wants to initiate the data transmission, it first senses the channel to check whether it is idle or not. If the channel is found idle, the source selects a random back off timer between 0 and CW (Contention Window). When the back off counter reaches zero, the source sends out a RTS for reserving the channel. Upon receiving the RTS, the destination sends CTS back after SIFS which contains the location information of the destination. Any terminal that receives both RTS and CTS and does not interfere with other transmissions in its range can be regarded as a relay candidate. The Winning Relay is the one which has maximum residual energy and minimum transmitting power.

3.2.Cross-Layer Cooperative Diversity Aware Routing

The step by step procedure followed in the proposed cross layer cooperative diversity aware routing is shown in Figure:2.

1. BEGIN
2. INITIALIZE NODE = IDLE
3. CHANEL SENSING
4. If (NODE_BUFFER == EMPTY) GOTO 2
5. NODE HAS DATA TO SEND
6. If (CHANNEL == BUSY) RandomBackoff
7. If (CHANNEL == IDLE for DIFS duration)
8. {send RTS to DEST_NODE
9. Wait for SIFS duration
10. If (CTS_RECEIVED == FALSE) THEN Random Backoff GOTO 3
11. Else
12. If(FLAG_P==0))&&(TRANSMITTING POWER <THRESHOLD) Direct transmission
13. { Send DATA to DEST_NODE
14. If (CHK_SUCCESS == TRUE) GOTO END
15. Else
16. If(FLAG_P==0))&&(TRANSMITTING > POWER THRESHOLD
17. {SELECT WTH such that
18. ((RATE == REQ)&&(NO_OF_FAIL <THRESHOLD)&& (POWER>MIN_POWER)
19. If(WTH _SELECTED == TRUE)
20. { Send DATA to WTH 21.WTH send DATA to DEST_NODE
22. If (CHK_SUCCESS == TRUE) GOTO END FAILURE GOTO 3
23. Else { NO_OF_FAIL ++
24. If (RETRY_LIMIT_EXCEEDED == TRUE)
25. { DELETE packet from BUFFER
26. GOTO 1
27. }
28. END CHK_SUCCESS
1. If (ACK_RECEIVED after SIFS == TRUE)
2. { SUCCESS
3. RETURN TRUE}

Figure: 2. Diversity aware routing algorithm

3.3 *AODV Routing protocol*

AODV is a reactive routing protocol which broadcasts discovery packet only when it is necessary. From the experimental results, AODV has the highest packet delivery ratio, when run over IEEE 802.11 DCF MAC layer. AODV performs best for the higher mobility scenarios and outperforms the other protocols. This is because the collision avoidance mechanism incorporated into IEEE 802.11 for the transmission of RTS packets aids in the reduction of the number of collisions. Thus AODV routing protocol is used in proposed scheme.

3.4.Results and Observations

The proposed work is simulated using network simulator NS-2.38 and the performance is analyzed based on delay, throughput and network lifetime. Initially wireless communication is established between the nodes in the network. The nam output trace in Figure: 3. represents the cooperative transmission between the source terminal (ST) and the destination terminal (DT).

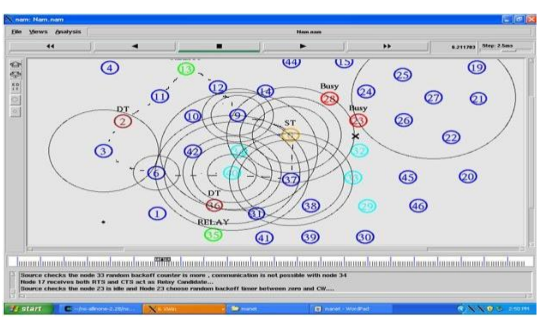

Figure: 3. nam Trace of the proposed model.

Figure: 4. Comparison of Delay.

Initially for packet transmission the AODV routing protocol selects a route and transfers the packet through the established route. Then the proposed DELCMAC protocol establishes a path by selecting a winning relay terminal. Now the source transmits the packets along both the established route which is referred to as cooperative communication. The nam output trace in Figure: 3. shows that the number of relay terminals has been increased in the proposed method making it suitable for large scale network. It also represents the busy terminals in the network which implies that the hidden terminal and exposed terminal problems are solved in the proposed method. The source terminal simultaneously transmits the packets to more than one destination terminal.

Figure: 5. Comparison of Throughput.

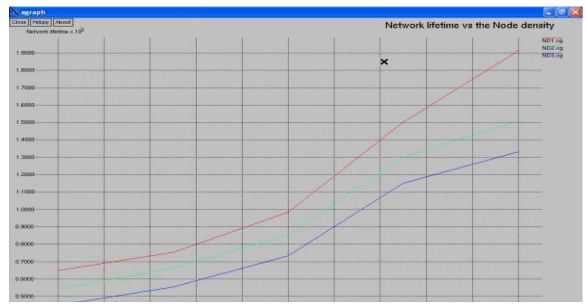

Figure: 6. Comparison of Lifetime.

From the trace file generated in NS2 window the readings of the relative position, energy, delay, data delivery rate are all observed and the graphs for packet delivery ratio, network lifetime and the overall throughput of the proposed system compared with the existing system is plotted in the X-graph as shown in Figure: 4,5&6.

Conclusion

In this paper, Cooperative Communication (CC) is used to conserve the energy in MANET. In addition a cross layer approach is employed here, to provide interaction between PHY-MAC layers. The power allocation is done in physical layer and routing is done in MAC layer. With DEL-CMAC, cooperative diversity routing plays an important role in increasing the throughput and reliability of the system. The simulation results ensure that the proposed DEL-CMAC along with cooperative diversity aware routing can significantly prolong the network lifetime comparing with IEEE 802.11DCF and DEL-CMAC, at relatively low delay degradation and improved throughput.

References

1. H. Shan, P. Wang, W. Zhuang, and Z. Wang, “Cross-layer cooperative triple busy tone multiple access for wireless networks,” Proc. IEEE Globecom, pp.1-5, Dec. 2008.
2. P. Liu, Z. Tao, S. Narayanan, T. Korakis, and S. S. Panwar, “Coop- MAC: a cooperative MAC for wireless LANs,” IEEE J. Selected Areas in Comm., vol. 25, pp. 340-354, Feb. 2007.
3. S. Moh, and C. Yu, “A Cooperative Diversity-based Robust MAC Protocol in Wireless Ad Hoc Networks,” IEEE Trans. Parallel and Distributed Systems, vol.99, May 2011.
4. X.Wang, Jie Li “Improving the Network Lifetime of MANETs through Cooperative MAC protocol Design”, IEEE Trans. Parallel and Distributed systems, Vol.26, No.4,April 2015
5. X. Wang, J. Li, and M. Guizani, “NCAC- MAC: Network Coding Aware Cooperative Medium Access Control for Wireless Networks,” Proc. IEEE WCNC, pp. 1646- 1651, Apr. 2012.