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# Enhancing *Power Unbiased Cooperative Media Access Control* Protocol in Manets

Mr. Gudditti.Viswanath[1], Mr. G.Sreenivasulu[2], Mr. T. Sunil Kumar Reddy[3]
[1,3]*(Asst. Professor, Dept of C.S.E, Sir Vishveshwaraiah Institute of Science & Tech. , Madanapalle, Andhra Pradesh, India)*
[2]*(Asst. Professor, Dept of C.S.E, ABR college of Engineering, Kanigiri, Andhra Pradesh, India)*

***Abstract:*** *In order enhance the network efficiency of Mobile ad hoc Networks (MANETs), an Power Unbiased Cooperative Media Access Control(PUC-MAC) protocol in MANETs was planned during this paper. It adopted the most effective partnership choice statement to select the cooperative node with higher channel condition, higher passing rate and additional balanced power consumption. Simulation results showed that PUC-MAC outperforms EC-MAC,Cooperative MAC (CoopMAC) and IEEE 802.11 Distributed Coordination perform (DCF) in terms of the packet release quantitative relation, network outturn and network lifespan beneath 2 distinct channel noise levels, particularly beneath the worst channel condition.*

## I. Introduction

Cooperative communication [1] that get filled advantage of the broadcast nature of the wireless channel and creates spatial diversity is changing into a promising technology for wireless networks. Research verified that cooperation communications are able to do nice improvement within the network capability, delay, robustness, power consumption and important reduction in interference furthermore. the first assessment of the cooperative communication was for the physical layer cooperation [2][3], and currently it's been developed to the Media Access control (MAC) layer [4][5] and also the network layer [6][7]. Some scholars additionally targeted on the cross-layer cooperation style [8][9], coupling the practicality of multiple layers, so as to improve the network capability.

In this paper, we tend to planned a brand new cooperative mac protocol, Power Unbiased Cooperative Media Access Control(ECMAC), in Mobile ad hoc Networks (MANETs). In PUC-MAC, the recipient takes 3 factors into consideration, the wireless channel condition, passing rate and power fairness issue, so selects a single supportive node among all the neighbors consistent with the most effective partnership choice statement. The rest of paper is planned as follows: associated work on cooperative mac is summarized in Section two. Section 3 describes the simplest exchange chosen statement. Section four describes the PUC-MAC protocol in details. Simulation results and performance comparison of 3 protocols area unit given in Section five. Finally, Section 6 concludes the paper.

## II. Related Work

In this paper PUC-MAC protocol compare with two similar mac protocols i.e relay-enabled DCF (rDCF) [4] and Cooperative mac (CoopMAC) [5], are both planned by taking the advantage of the multirate capability of IEEE 802.11., Every node maintains a cooperative table, wherever the desired data of the applicant cooperative nodes is keep. CoopMAC and rDCF each send packets in a very high rate two-hop manner rather than low rate one-hop manner, and thus advance the network capability. The Cooperative mac protocol (CO-MAC) [10] was designed to supply better performance as a result of the receiver diversity gain than rDCF and also the implementation quality is as low as that of rDCF. The Network committal to writing enabled Cooperative mac protocol (NC-MAC) [11] tried to mix the cooperative connections with the network committal to writing approach. Simulation outcome explain that this protocol supply bigger network outturn by the network committal to writing gain than rDCF. TheOpportunistic Cooperative mac protocol (OC-MAC) [8] was planned supported the cross-layer data utilization. Opportunistic cooperative [12] strategy was conjointly exploited to apply communicate only it will improve the presentation of network system. Moreover, the relay node choice considers the channel weakening issue. The work [13] conjointly planned a cooperative mac protocol supported the expedient relaying, wherever the node with the simplest channel value among all the neighbors is chosen because the cooperative node. This protocol will significantly recover the network presentation once the standard of the passing mechanism path is poor.

## III. Simpcfdxzzxcedxlest Exchange Chosen Statement

Defective wireless weakening channels and restricted power of mobile workstation prohibit the full network presentation. so as to avoid these issue caused by behavior of MANETs and improve QoS of the network, a best partnership chosen algorithm is conferred during this section.

Each node keep a communication table, shown in Table one. Through the exchanges of the management frames, each node store the mac addresses of its neighbor $NH_i$ and therefore the end $E_i$, the most recent time $P_i$ once getting the packets from the neighbor, passing rate $T_{shi}$ between the neighbor and itself, passing rate $T_{hid}$ between the neighbor and therefore the end, outstanding power $PE_{ri}$ of the neighbor, and average channel condition $CC_i$ of the path from the start to the end through the neighbor. The cooperative table is periodically updated and records the most recent instant data of all its neighbors.

Table 1: Format Of Communication Table

| | | | | | | |
|---|---|---|---|---|---|---|
| MAC Address Of $NH_1$ | MAC Address Of $ET_1$ | $P_1$ | $T_{sh1}$ | $T_{h1d}$ | $Op_{r1}$ | $CC_1$ |
| ……. | ……. | ………. | ……. | ……… | …… | |
| MAC Address Of $NH_n$ | MAC Address Of $ET_n$ | $P_n$ | $T_{shn}$ | $T_{hnd}$ | $Op_{rn}$ | $CC_n$ |

Once the start must send packets to the end, it'll 1st verify chosen there's a neighbor node satisfying the need within the cooperative table. The need is shown in statement one, wherever $CC_d$ is the channel condition of the path directly from the start to the end.

$$CC_i \geq CC_d \qquad (1)$$

If here is one node, it'll be choosen because the cooperative node. If there's quite one node agreeable the necessities, the start node adopts the simplest exchange chosen statement. Otherwise, the start can throw packets on to the end in line with the normal IEEE 802.11 DCF. Average channel condition (CC) is calculated in statement two, and therefore the channel condition between any 2 nodes is calculable on the signal-to-noise ratio (SNR) of the received signal. CC is that the mean value, and imitate the common channel quality from the start to the end within the two-hop manner. The larger the CC, the higher the channel quality is.

$$CC=2/(1/CC_{sh}{}^{+}1/CC_{hd}) \qquad (2)$$

Then the start calculates the passing time through cooperation ($P_{coop}$) and therefore the power fairness factor (η), as shown in statement three and four.

$$P_{coop}=1/T_{sh}+1/T_{hd} \qquad (3)$$

$$\eta=OP_i/OP_r = (X_r/T_{sh}+X_t/T_{hd})/P_r \qquad (4)$$

Since the values of $P_{coop}$, CC and η area unit obtained, a nearest with shorter passing time, higher channel condition and better power utilization ought to be selected because the cooperative node. Therefore, we have a tendency to introduce Y, a chosen criteria to be utilized by the start for the cooperative node chosen.

$$Y=P_{coop}\ \eta\ /C \qquad (5)$$

Obviously, the neighbor with the littlest Y is selected because the cooperative node. The beginning of the power fairness issue will efficiently avoid things that some neighbor is often selected because the cooperative node which results within the early death and network divider. Even though the chosen technique considering the power fairness issue doesn't guarantee to reduce the entire power consumption, it can higher the lower worth of the outstanding power and carry on the power levels of all the nodes within the network in a very unbiased state. Therefore, the introduction of the power fairness issue η will extend the network life by make longer the node continued existence time.

## IV. PUC-MAC Protocol

Besides 3 management frames (RTS, CTS and ACK) supported in IEEE 802.11MAC, 3 new frames are introduced in PUC-MAC. they're Cooperative Request-to-Send (SRTS) frame, Guide-to-Send (GTS) frame, and supportive Clear-to-Send (SCTS) frame. The greeting process of PUC-MAC is expressed as follows.

1) Before the passing of an information packet, if the start finds a cooperative node, it senses the channel to see if it's idle for a DCF Interframe space (DIFS) time. once the start has completed the desired backoff procedure, a SRTS frame (including the mac address of the cooperative node) are sent, and this frame additionally reserves the channel for Network distribution Vector (NDV) duration. If the start cannot realize a supportive node, it sends RTS frame on to the end.

2) Once the neighboring node receives SRTS, it checks whether or not it's the cooperative node. If it's and is able to participate within the cooperative communication, it sends the GTS frame once a brief Interframe house (BIFS) time and additionally reserves the channel for NDV length.

3) Once the end receives SRTS so receives GTS once a BIFS time, it sends SCTS, indicating the cooperation communication is arranged. If the end receives SRTS, however doesn't receive GTS in GTS_timeout duration, it sends CTS, indicating the direct communication is prepared. Meanwhile, the end reserves the channel for NDV length.
4) If the start receives GTS and SCTS in SCTS_timeout duration, it sends information packets to the cooperative nodes. If the start receives CTS from the end, it sends information packets on to the end.
If the starts accept neither SCTS nor CTS, the channel competition fails and therefore the start resumes the back off method.
5) The end specify its victorious reception of the information packet by distribution ACK directly back to the start.
6) If the start obtain SACK, the information passing is victorious and therefore the start stays idle. If the start does not obtain SACK in SACK_timeout duration, the information passing fails and therefore the start resumes the backoff procedure and contends the channel once more.

## V. Performance Evaluation

In order to judge the presentation of PUC-MAC, we have a tendency to simulate IEEE 802.11 DCF, CoopMAC [14],EC-MAC[17] and PUC-MAC by victimization Network simulator 2 (NS2) [15] network simulator. Nodes are homogeneously spread in an area of 500m×700m and capable to shift arbitrarily with the speed of 0-7 m/sec. for various necessities of the presentation scrutiny, the quantity of nodes varies from 5 to 50.

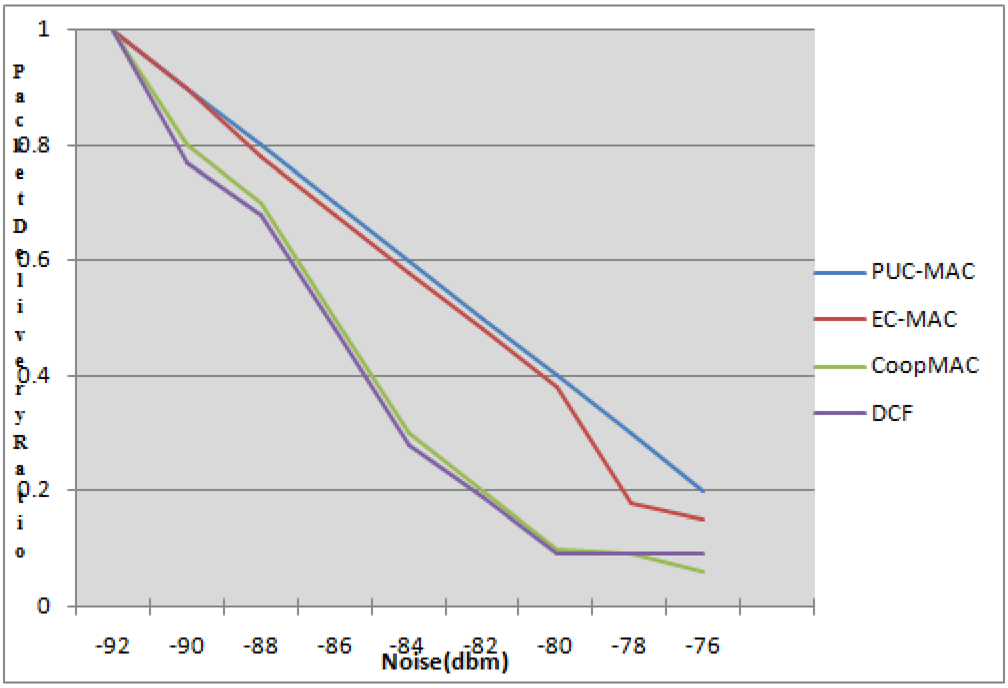


**Figure 1: Packet delivery ratio as the noise level increases**

The passing power is mounted to 1.52W and therefore the receiving power is mounted to 1.3W. The initial power of every nodes is about to 50J. Multirate ability of IEEE 802.11b is used and 4 totally different rates, 1Mbps, 2Mbps, 5.5Mbps, and 11Mbps Gaussian supported. so as to simulate a additional realistic reception model, we have a tendency to adopt the changed signal reception model in [16], that takes BER into thought once determinant the success or failure of a received signal. The setting noise level of -78dBm to -90dBm is modeled as a Gaussian random variable with the standard deviation of 1 dB. every simulation runs for 600 seconds. 3 performance metrics, packet release magnitude relation, network throughput and therefore the network lifetime modified evaluated.

Figure one shows the packet delivery magnitude relation of 4 protocols with totally different setting noise levels from -92dBm to -76dBm.The quantity of node is 50 during this situation. we are able to observe that the performance of 4 protocols all degrade sharply because the noise level will increase. Since PUC-MAC considers the direct condition in the cooperation communication and knowledge packets can be transmitted on the links with privileged quality, ECMAC again and again outperforms the opposite 3.
Figure 2 shows the network outturn of 4 protocols because the range of nodes will increase with two situation noise levels of -92dBm and -84dBm.

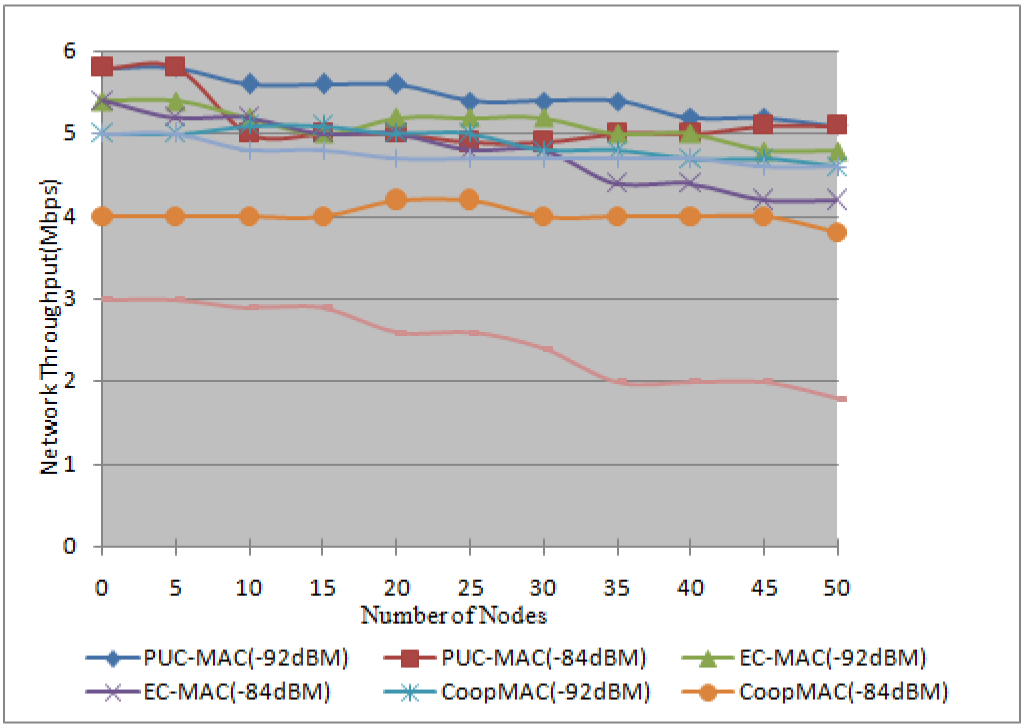


**Figure 2: Network throughput as the number of nodes increases**

Network outturn of 4 protocols all reduce because the noise level and therefore the range of nodes raise. PUC-MAC executes best since it obtain channel condition into deliberation. EC-MAC performs higher than CoopMAC outstanding to the advantages of collaboration, so the range of nodes will increase, there are additional applicant nodes to be chosen because the cooperative nodes, and so the network throughput is enhanced. Figure 3 shows the network lifespan of 4 protocols because the range of nodes will enlarge with the surroundings noise levels of -92dBm. During this situation, the initial power of nodes is haphazardly set in [4J, 50J]. We can observe that the network lifespan of 4 protocols all will raise because the range of nodes will increase. PUC-MAC has the longest lifespan, whereas EC-MAC, CoopMAC and DCF each perform worse. Simulation results verify that the power fairness think about the most effective partnership chosen algorithm will alance the power consumption of nodes and prolong the network lifespan

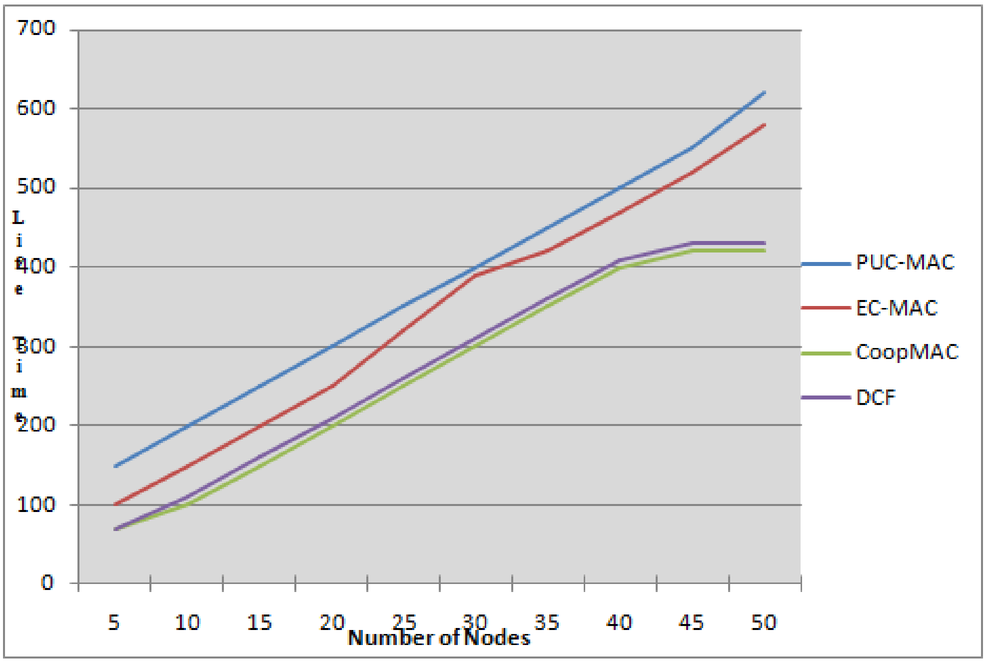


**Figure 1: Network lifetime as the number of nodes increases**

## VI. Conclusion

Time-honored cooperative MAC protocols are projected to extend the information passing rate and so improve the network outturn. However, they are doing not take into account the QoS caused by the unreliable wireless environment and restricted power restarts. so as to resolve these issues, we have a tendency to projected associate degree power balanced cooperative raincoat protocol, PUC-MAC, in MANETs. Through the most effective partnership choice algorithm, the cooperative node with higher channel condition, higher passing rate and power fairness factor is chosen to participate within the cooperation communication. Simulation results verify that PUC-MAC can improve the packet delivery magnitude relation, network outturn and therefore the network lifespan over EC-MAC, CoopMAC and IEEE 802.11 DCF in several communication environments.

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**BIOGRAPHIES**

**Gudditti. Viswanath** is born in 1982 in India. He is graduated in **B.C.A** from Osmania University, Hyderabad, post graduated in **M.C.A** from S.K. University and second post graduated in **M.Tech** from JNTU Anantapur. He is currently working as a Assistant professor in the department of Computer science and engineering at Sir Vishveshwaraiah Institute of Science and Technology, Madanapalli.

**G. Sreenivasulu** is born in 1988 in India. He is graduated in **B.Tech** from JNTU Anantapur, Post graduated in **M.Tech** from JNTU Anantapur. He is currently working as a Assistant professor in the department of Computer science and engineering at ABR college of Engineering, Kanigiri.

**T. Sunil Kumar Reddy** is an associate professor in the Department of Computer science & engineering at Sir Vishveshwaraiah Institute of Science and Technology, Madanapalli. He received the B.Tech degree in Information Technology from Satyabhama University in 2005, the M.Tech degree in Information Technology from V.I.T University in 2007and he is pursuing PhD degree in computer science & engineering from JNTUA University, Anantapur. His research interests include Cloud Computing, High performance computers, Wireless Networks.