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Applying Idling Methods In Multicast Routing Protocol For Reducing Energy Loss And Improving Residual Energy In Mobile Adhoc Networks

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Abstract— In this paper, we propose Idling mechanism for reducing energy loss in MANET. As MANET nodes typically run from limited energy portable batteries, a critical design was made for reducing energy loss and Erroneous Carrier Sensing. Energy savings are realized by exploiting the difference in power consumption between the Erroneous Carrier Sensing and idle states. The proposed method is Applying Idling Methods in Multicast Routing Protocol for Reducing Energy Loss and Improving Residual Energy in Mobile Adhoc Networks. Idling methods are used to avoid spending energy on overhearing by forcing the overhearing node's radio interface to transition to a low energy idling mode and for reducing energy consumption due to Erroneous Carrier Sensing (ECS).

Index Terms— Erroneous Carrier Sensing, Idling, Mobile Adhoc Networks, Multicast routing protocols, Overhearing.

I. INTRODUCTION

A Mobile Ad hoc Network (MANET), sometimes called a mobile mesh network, is a self-configuring network of mobile devices connected by wireless links. Each device in a MANET is free to move independently in any direction, and will therefore change its links to other devices frequently. Each must forward traffic unrelated to its own use, and therefore be a router. The primary challenge in building a MANET is equipping each device to continuously maintain the information required to properly route traffic. Interface idling mechanism is used for improving energy efficiency of IEEE 802.11 based on MAC hardware. A novel protocol state analysis techniques is developed for detecting time windows during which a wireless interface consumes energy due to 802.11 overhearing. During this window, energy savings at the MAC layer is accomplished by forcing the wireless interface to a relatively lower-energy idling state. At the end of this window the interface is transitioned back to its regular receiving mode. The goal is to avoid spending energy loss by using O-Idling and E-Idling methods. [1], [2]. O-idling method is done by forcing node A's radio interface to transition to a low-energy idling mode during node B's transmission to node C. The idea behind E-idling is, when a node starts receiving ECS signal, its wireless interface is forced to switch to the low-energy idling state till the transmission causing ECS is over.

II. IDLING METHODS

II.1 Overcoming Overhearing and Latency Using O-Idling Method

The goal is to avoid spending energy on overhearing by using O-IDLING method. O-idling method is done by forcing node A's radio interface to transition to a low-energy idling mode during node B's transmission to node C. It exploits the NAV (network allocation vector) mechanism in 802.11 to accomplish forced idling. When node A overhears the B->C RTS, it looks at the NAV value in RTS, which indicates the duration of packet transfer till the end of C->B ACK transmission .upon overhearing the RTS,A should force its radio interface to idling state and schedule a transition back after the end of the C->B ACK Similar techniques are applicable for node D, which forces its interface to idle based on the NAV it has found in the overhear B->C data, even without forced idling it is likely to spend a significant part of that NAV duration idling, except when it overhears C->B ACK and possible erroneous carrier sense from nodes that are far. As a result reduction of overhearing energy at node D is less than that at a node A, At D, however, a certain amount of erroneous carrier sensing energy is saved due to O-idling [1].

This mechanism reduces the time a node spends in ECS mode and increases duration of low energy idling, and in turn reduces the energy consumed due to ECS. It is evaluate this mechanism through simulation and show that this forced state-switching can extend network life significantly by cutting on ECS energy expenditure [2].

Now let us consider the situation which an X->Y packet transmission is initiated while node A was in o-idling state. Since A has missed the Y->X CTS, when it comes out of the O-idling it has no knowledge of the ongoing X->Y data transmission. At this point if A has a packet to transmit to either Y or B, it may potentially collide with X->Y data at node Y. It calls this as idling-collision. Similar issues exist after node D comes out of its o-idling, to address this we impose a restriction that after the end of O-idling, to address this we impose a restriction that after the end of o-idling, a node should wait or duration T_{guard} before attempting a transmission.

In the example, if X->Y Transmission and its ACK end before A's T_{guard} is over then node Y will be protected from idling-collisions. A large T_{guard} value provides better protection from idling-collision, but it also brings the channel capacity down by forcing nodes not to transmit during that guard period. On the other hand, for very small T_{guard} values, the effective channel capacity will suffer use to idling-collisions. Therefore, an optimum T_{guard} has to be set as shown in the Fig.1.

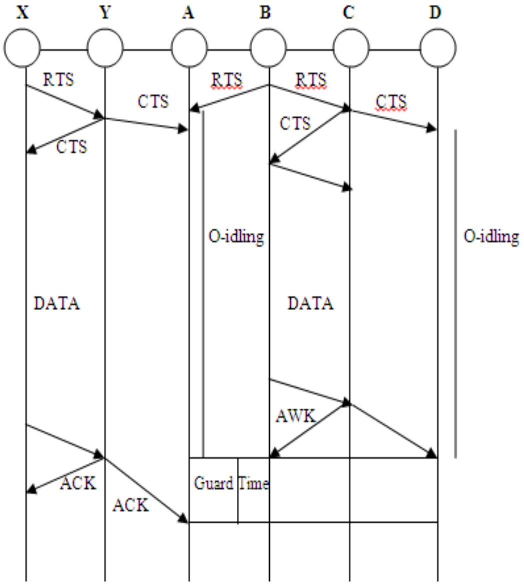

Fig.1 O-idling Method

II.2 Reducing Energy Consumption Using E-Idling Method

E-idling as a mechanism for reducing energy consumption due to erroneous carrier sensing (ECS).The idea behind e-idling is when a node starts receiving ECS signal, its wireless interface is forced to switch to the low-energy idling state till the transmission causing ECS is over. Consider the scenario in Fig.2, in which node A is outside node D's receive range but within its carrier sense range. Node C, on the other hand, is within the receive range of D. After an RTS-CTS transaction, when D starts sending a data packet to node C, D's transmission appears as ECS signal to A, which cannot transmit or receive during this packet duration.

According to e-idling, upon reception of the ECS signal the interface at node A goes to a forced idling state and eventually transitions back after anticipated data duration T^{MAX}_{Data}. In between, the interface wakes up twice; first time after an anticipated MAC layer control packet duration T^{Max} and for a second time which is after an anticipated AODV control packet duration $T^{Max}_{Aodv\_ctrl}$. The rationale behind first intermediate wakeup is to respond to the scenario where the received ECS signal corresponds to a MAC layer RTS or CTS. If after waking up the node finds that the ECS signal still persists then it goes back to the forced idling state.

The second wakeup is to address the situation where the received ECS signal corresponds to an AODV RREQ, RREP or RERR message. If the ECS signal still persists then the node assumes that the ECS signal is data and it goes back to forced-idling till T^{MAX}_{Data} duration since start of the idling expires. The quantities are $T^{Max}_{MAC-Ctrl}$, $T^{Max}_{Aodv\_ctrl}$, T^{MAX}_{Data} determined based on past measurements and they accurately reflect maximum durations of different packet types in the system [3].

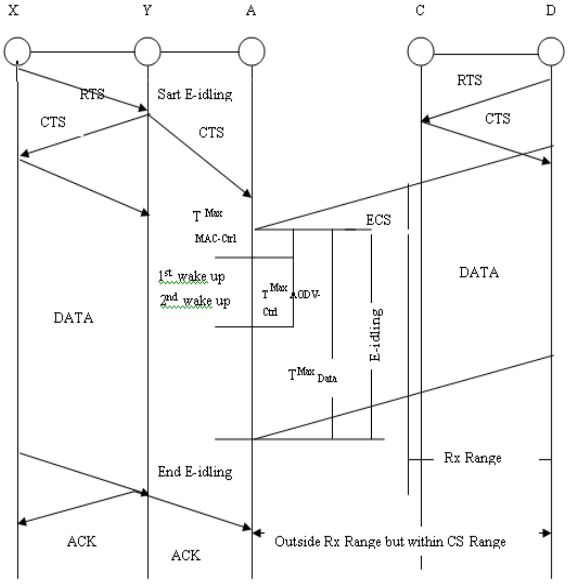

Fig.2 E-idling Method

III. MAXIMUM-RESIDUAL MULTICAST ROUTING PROTOCOL

A distributed methodology and its implementation are proposed to resolve the maximum-residual multicast problem. It is used to derive a multicast tree with the best energy efficiency, where each node makes its own decision autonomously. A routing protocol is then developed in as a realization based on the proposed algorithm [4].

III.1 Distributed Algorithm

Based on each multicast tree T derived by the proposed algorithm, every node is able to adjust its power level in packet transmissions so that the residual energy over a network G= (V, E) is maximized for a given multicast session S. Let the source and the destination set of S be denoted by s and R, respectively. Given each node $v \in V$ under considerations, $\pi[v]$ and $m[v]$ are used to keep track of its predecessor and estimation on the residual energy over a path from s to itself during the execution of the algorithm, respectively [5].

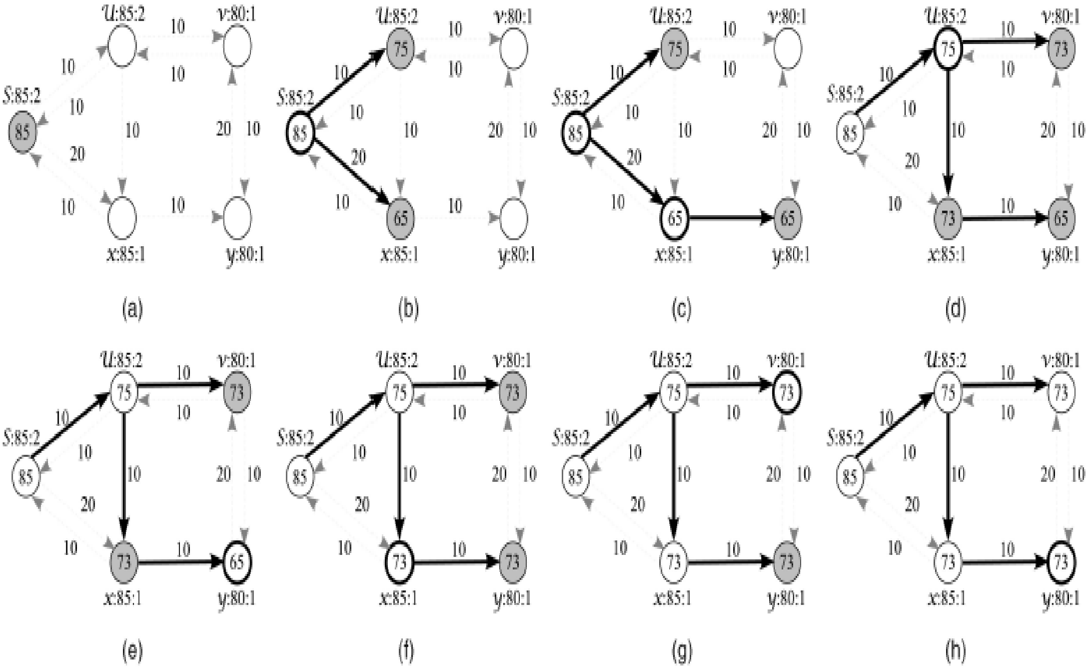

Fig. 3 The execution of MRMA on an example network

Algorithm: MRMA
For source s

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if s has a session S of data packets to multicast to nodes in R then
    Create an entry indexed by (s, S) at s;
    m[s]  ← β(s);
    π[s]  ←  NIL;
    Broadcast  msg(s, S, m[s], β(s), m[s], 0) to all of its neighbours;
For a node v other than s
if v receives msg(s; S, β (u), m[u], γ (u)) from a neighbour u then
    if no entry is indexed by (s; S) at v then
        Create an entry indexed by (s; S) at v;
        m[v] ←0;
        π[v] ← NIL;
    if m[v] < min{m[u], β(u)_ ω(u,v)- γ(u). β(v)- γ(v)} then
        m[v] < min {m[u], β (u) _ ω (u, v) - γ (u). β (v) - γ (v)}
        π[v] ← u
        Broadcast msg(s; S, β (v), m[v], γ (v) to all of its neighbours
```

IV. SIMULATION AND RESULTS

IV.1 Residual Energy Comparison

Residual Energy is measured in simulation. Fig. 4 shows Residual energy comparison between (Existing system and O-idling method). Green line shows the Residual energy in proposed system (O-idling) and red line shows the Residual energy in existing system. Fig. 5 shows Residual energy comparison between (Existing system and E-idling method). Green line shows the Residual energy in proposed system (E-idling) and red line shows the Residual energy in existing system. In both cases, Residual energy maximized in the proposed system (O-idling method) has better performance than the existing system.

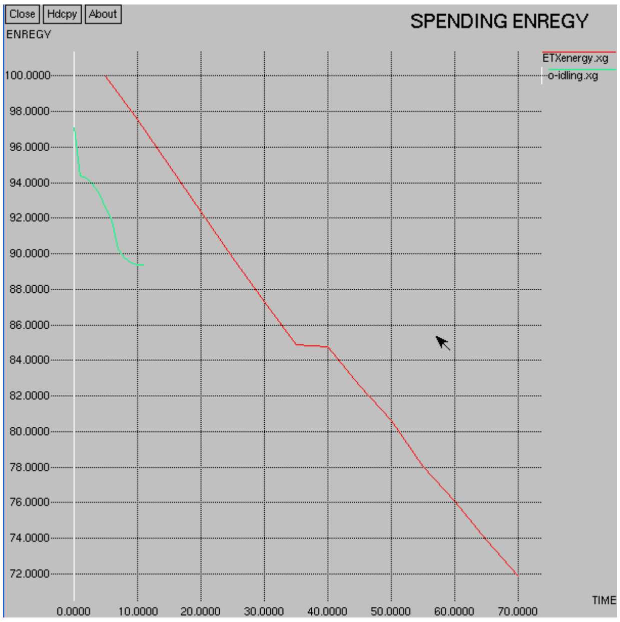

Fig.4 Residual energy comparison (O-idling)

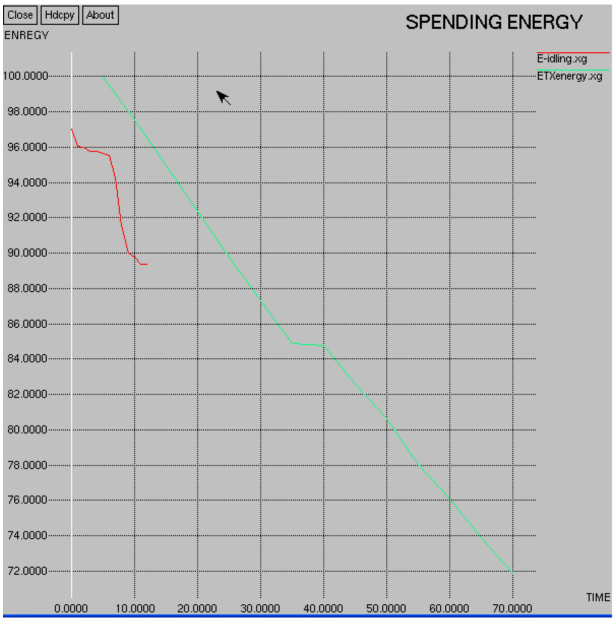

Fig. 5 Residual energy comparison (E-idling)

IV.2 Delay Comparison

Fig.6 shows Delay comparison between (Existing system and O-idling method) Green line show that the Delay in proposed system (O-idling) and red line shows that the Delay in existing system. Delay is minimized in the proposed system (O-idling method) and thus has better performance than the existing system. Fig.7shows Delay comparison between (Existing system and E-idling method) Green line show that the Delay in proposed system (E-idling) and red line shows that the Delay in existing system. Delay is minimized in the proposed system (E-idling method) and thus has better performance than the existing system.

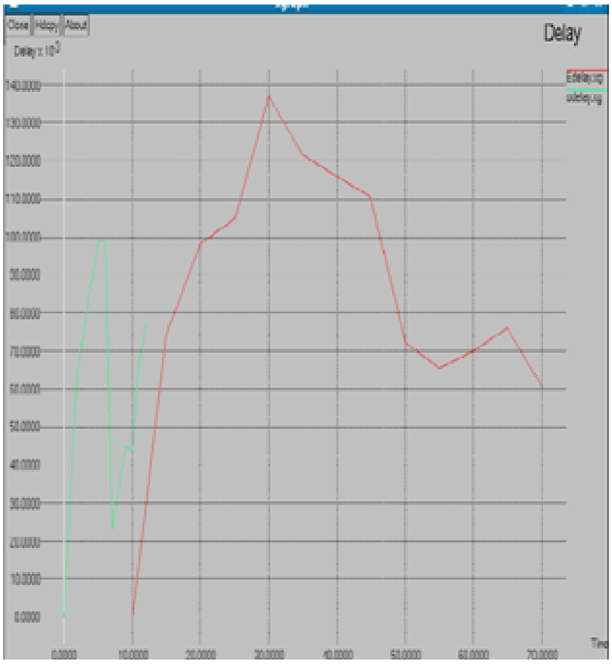

Fig.6 Graph representing Delay versus Time

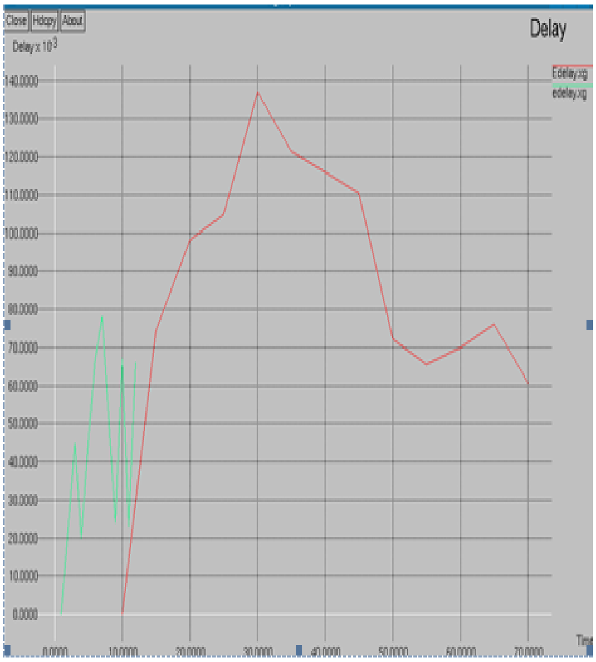

Fig.7 Graph representing Delay versus Time

IV.3 Drop Comparison

Fig.8 shows Drop comparison between (Existing system and O-idling method) Green line show that the Drop in proposed system (O-idling) and red line shows that the Delay in existing system. Drop is minimized in the proposed system (O-idling method) and thus has better performance than the existing system. Fig.9 shows Drop comparison between (Existing system and E-idling method) Green line show that the Drop in proposed system (E-idling) and red line shows that the Delay in existing system. Drop is minimized in the proposed system (E-idling method) and thus has better performance than the existing system.

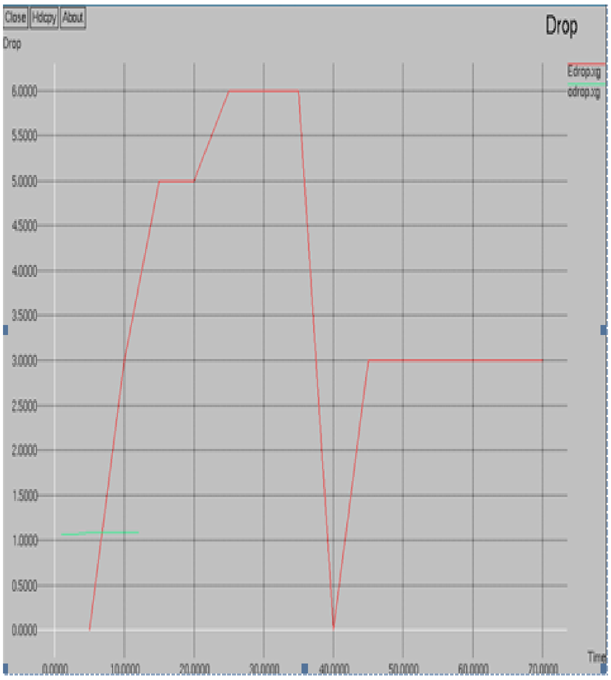

Fig. 8 Graph representing Drop versus Time

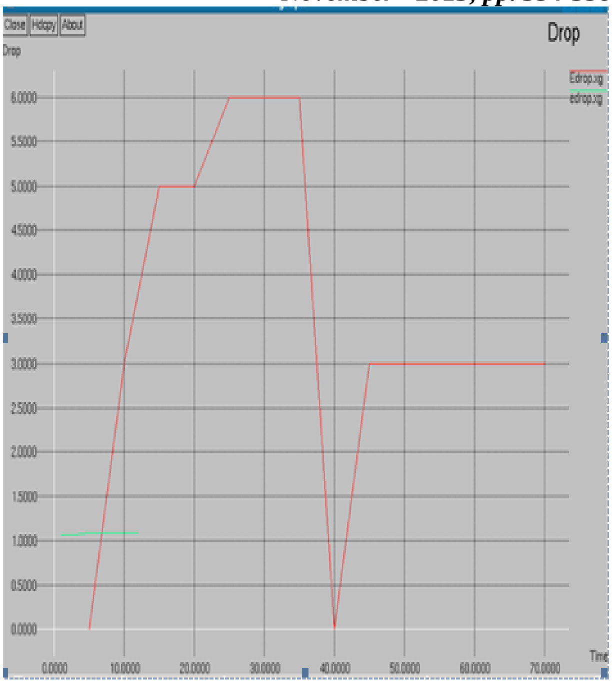

Fig. 9 Graph representing Drop versus Time

V. CONCLUSION

It is proposed and analysed a forced interface idling mechanism for reducing energy loss due to overhearing and erroneous carrier sensing in wireless interfaces. The proposed system, implemented with the help of Network simulator, is used to maximize residual energy, which was initially 0.893% and have been improved to 0.975% in O-idling method and 0.998% in E-idling method. The system also reduces the latency experienced in packet transmission, which was initially 0.00085% and have been reduced to 0.00035% in O-idling method and 0.00047% in E-idling method. In future, it will explore multisource maximum-residual multicast problem, where multiple sources are considered simultaneously by using this energy saving method.

REFERENCES

1. Biswas S and Datta S (2004) "Reducing Overhearing Energy in 802.11 Networks by Low-Power Interface Idling", IEEE International Conference on Computing and communications, pp. 695 – 700.
2. Datta S and Biswas S (2005) "Energy Savings by Intelligent Interface Idling in 802.11 Based Wireless networks", IEEE International Conference on Electro Information Technology, pp. 6.
3. Bertsekas D and Callager R, (1987) "Data Networks", 5th International conference on computing and communication, pp.325- 333.
4. Hisu P.C. National Taiween University, Taipei, (November, 2009) "A Maximum-Residual Multicast Protocol for Large-Scale Mobile Ad Hoc Networks," IEEE Transactions on Mobile Computing, vol. 8, no. 11, pp. 1441-1453.
5. Jhonson D.B and Maltz D.A (1996) "Dynamic Source Routing in Ad Hoc Wireless Networks," Mobile Computing, pp.151- 181, Kluwer Academic Publisher.
6. Kurose J.F. and Ross K.W (2003) Computer Networking: A Top-Down Approach Featuring the Internet, second ed.,pp.451-455,484-486 Addision Wesely.
7. Lee S.J, Gerla M and Chiang C.C, (1999) "On-Demand Multicast Routing Protocol," Proc. IEEE Wireless Communication and Networking Conference, (WCNC '99).pp.1298-1304.
8. Perkins C.E and Royer E.M, (1999) "Ad-Hoc On-Demand Distance Vector Routing," Proc. IEEE Workshop Mobile Computing Systems and Applications (WMCSA '99), pp, 90-100.
9. Royer E.M and Perkims C.E, (1999) "Multicast Operation of the Ad Hoc On-Demand Distance Vector Routing Protocol" Proc.ACM MobileCom, pp.207-218.
10. Tel G, (2000) "Introduction to Distributed Algorithms", second edition, Cambridge University, pp 121-123.

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