# Energy Efficient P-manet MAC Layer Protocol with Variations in Beacon Window and Multihop Transmission Indication Map for Manet

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***Abstract* - Mobile Ad hoc Networks are designed of roaming mobile nodes using temporary network operated by battery power. This paper proposes a set of performance metrics in evaluating energy efficiency in MANETs, and studies the energy consumption of MANET from a variety of aspects: at different MAC layers including network layer, at different operation mode including idle, transmit and receive, with AODV routing protocols. Also I am changing Value of parameter like Beacon Interval Length, Beacon Window, Multihop Transmission indication Map, Mobility Speed, Node Density. Extensive simulations were run in the C compiler for various scenarios. The results and analysis reveal some important findings. A substantial amount of energy is consumed at MAC layer, especially at idle mode. IEEE 802.11 achieves completely different pattern in terms of its energy efficient when combined with AODV routing protocols. And I am changing value in P-Manet Protocol and also using synchronization & NAV with comparison between different value of BI, BW, MTIM window, Node Density and Mobility speed.**

***Keywords* - Mobile Adhoc Network; P-Manet; IEEE 802.11; Broadcasting, NAV**

## I. INTRODUCTION

Network [1]. Manet Means designed of roaming mobile nodes using temporary network operated by battery power for certain time and limited range. Manet is an infrastructure less and not require any centralize node. But in Manet, cluster are create when node connected each other and each node working as sender and receiver [3].

**Medium Access Control**: several users can transmit at the same time over the same channel due to medium access control.Various MAC protocols have been defined in literatures that employ different techniques to legalize access. Dispersed and federal are the two categories of it. In the former, every node can choose best possibility to sending data to sender to receiver.If multiple nodes transmit, then these protocols provide mechanisms to resolve collision. In the centralized approach, A channel access because a node selected, and the this time it will check node over a channel. The centralized node is alsoknown as a base station (BS). Two different ways are available to provide access to channel. BS would regularly check if it has data to transmit or not. Base station can be request mechanism for each every node for sending data to base station. Base station provides a time slot to every node to receiving a request.The next sections discussdifferent MAC protocol.

**Aloha**: The principle fulfilled the Aloha is that don't wait if you have data to send. If collision occurs then protocols resend the data.The improvement of slotted aloha is discussed in below portion. Time divided in discrete time slot which mechanism provided by slotted aloha. when time slots begin than A node can only transmit. This helps in reducing collisions.

**CSMA:** This stands for Carrier Sense Multiple Access with Collision Detection. In CSMA, sensing of traffic on same shared medium before transmitting occur.If they detect another node is transmitting then it waits until completion of that transmission.

**CSMA/CD:** Carrier sense multiple access in CD that verified that when collision occur at any conjunction or cross layer. at that time it will retransmit the nodes. Also time taken for this randomly which retransmits the frame to the particular nodes. Above technique is used to solve the collision problem and it used in 802.3 networks and above.

**CSMA/CA:** Connectionless networks CSMA/CD works but CSMA/CA doesn't works. For that reasons in past transmitter founds very low.In wireless network for that reason of hidden deep problemthat at receiver side very helpful to detect the collision.

**IEEE 802.11:** This standard [5] specifies the Distributed Coordination Function (DCF) which is based on CSMA/CA.When channel in idle state for distributed inter frame space for this the transmitter wait for it. When it free it can start transmit the data. When it senses the channel is busy using DIFS it random transmitting data to avoid collision.The time after the DIFS period is slotted When it start to time slot and transmit the data.The exponential is the back off scheme which range display of uniformly (0, W). W display contenting window, variable in nature and its initial value Cwmin. Each time a node has to back off for the same frame after the first back off, it doubles the contention window. Window is not increment because of CWmax. When Ack receive by receiver the frame is send successfully or not. Also it is sending a frame 8 times after frame dropped in queue.

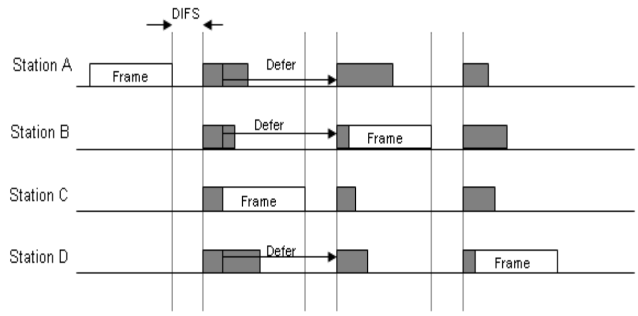



Fig. 3 Distributed Coordination Function (DCF)

**IEEE 802.16:** The network consist two type of station one is base [21] and other is sub scriber. Both point generated multipoint design structure. Multipleframesis allocated particular time slots and also consists uplink and downlinks. Base station controlled uplink and done as scheduling algorithm.

The Reduction of energy consumption by Mobile Adhoc Network has been studied widely. MAC protocols in energy efficient can be classified into two categories—synchronous wake up approaches [11-15] and asynchronous wake up approaches [16-20]. In synchronous wake up approaches, all nodes must execute a clock synchronization mechanism. Asynchronous wakeup approaches require no such synchronization mechanism. However, the discovery time is the most important issue in asynchronous wakeup approaches. They must adjust the overlap of a node's wakeup time with that of its neighbors, resulting in increased power consumption and long transmission delay .

## II. RELATED WORK

**Energy-efficient MAC layer protocols in Adhoc networks**

**Liu F at al.** [4] In this paper author says that Manet is as an autonomous system of mobile routers and connected by wireless links. Its Characteristics is Fast development, Dynamic multihop Topology, Self organization without typical infrastructure support. The Two Major Reason for Transmit Power Control is Transmit at a high power may increase the interference to Co-existing user and therefore degrade network and Energy efficient scheme can impact battery life, consequently prolonging the lifetime of the network. Sleep 14mA, Idle 178mA, Receive 204mA, and Transmit 280mA Energy consume for different Modes.

Low-power MAC designs guidelines are minimize random access collision and the consequent retransmission, Minimize idle listening, Minimize overhearing, Minimize control overhead. Explain about Scheduling-based mechanism for CDMA, FDMA, and TDMA for Mac protocol and different mechanism. Power Control Techniques explain different protocol. Power off mechanism explains about P-Mac, S-Mac protocol and mechanism. Multi-Channel Mechanism explain about different channels. Antenna-based mechanism it was explain about the radio base wireless protocols and radio transmission.

**A novel efficient power-saving MAC protocol for Multi-hop MANET**

**Hwang R at al.** [2] In this paper author says that MANET is a multi-hop wireless network that is formed dynamically from an accumulation of mobile nodes without the assistance of a centralized coordinator. The power consumption of a battery must be minimized to maximize its lifetime, the battery quickly run out of power, making the mobile node useless.

In p-MANET, the three mechanisms that are utilized to reduce power consumption and transmission latency are Hibernation – how to remove unnecessary noise, Beacon inhibition - to save energy each node enters PS mode unless it wakes up in beacon interval, Low-latency routing selection - to choose the most efficient next hop forwarding node. Sleep 0.045w, idle 1.08w, Receive 1.30w, and Transmit 1.875w Energy consume for different Modes.

**An Energy Efficient MAC Protocol for Ad hoc Network**

**Shi Y at al.** [5] In this paper, an author proposed a new energy efficient EEMAC protocol. The design is define that the ad hoc networks are data- driven, which means that the collect the data as receiver and dispense the data as a sender. Hence, all node on network are not awake because they are costly and unnecessary and also some node do not carry traffic load. The design protocol reserve energy by disable the radion node in network. The goal is to reduce energy consumption without significantly reducing network performance. The protocol is based on IEEE 802.11 and its power saving mode. It can pro-vide useful information to the network layer for route discovery.

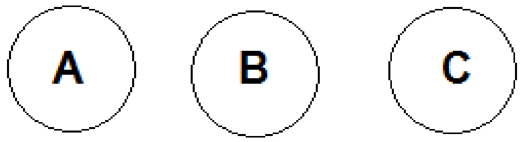
This paper is organized as an overview of cur-rent energy-efficient protocols for MANETs. Also Introduce IEEE 802.11 power saving mode (PSM) and describes the proposed protocol, EE-MAC. Sleep 0.07w, idle 0.89w, Receive 1.02w, and Transmit 1.4w Energy consume for different Modes.

**MACAW: A Media Access Protocol for Wireless LAN's**

**Vaduvur B at al.** [6] In this paper author says that medium access control with collision avoidance are better than csma because in this protocol solve the problem of hidden and exposed terminal also using the RTS and CTS mechanism. RTS means request To send and CTS means clear To send.

MACA uses two types of short, fixed-size signaling packets.

Example:




## III. PRAPOSED METHOD

In p-MANET, time is divided into several periods, called beacon intervals. A beacon interval structure of p-MANET protocol with three intervals. Each beacon interval consists of three windows, the BW, the MTIM window, and the data window (DW). Notably, the MTIM window serves a similar purpose to the ATIM window in IEEE 802.11. The power management mode of a node in p-MANET is listen or PSM. In listen mode, a node wakes up and can receive data. For most of the rest of the time, it sleeps, except when it is transmitting data. To synchronize the clock and to discover neighbors, a mobile node periodically sends a beacon to eliminate the drift time with neighbor nodes in each BW, regardless of whether it is in the listen or the sleep mode. Additionally, on the basis of the characteristics of wireless communication, each node is assumed to know the MAC addresses of it neighbors.

The main goal of the design of p-MANET is to minimize power consumption, message overhead, and transmission

latency in multi-hop MANETs. The hibernation mechanism assumes that all nodes can be synchronized by applying a global synchronization algorithm, such as MTSP [20] or other synchronization algorithms. Each node only enters listen mode once every N intervals to avoid consuming power on unnecessary tasks, such as idle listening, collision, overhearing, and control mechanism. The beacon inhibition mechanism is developed to solve the beacon storm problem. The low-latency next-hop selection mechanism supports a heuristic strategy for efficiently selecting a next-hop neighbor node for forwarding packets.

**Algorithm:**

1. Initialize all variable and Time.
2. Design Destruct graph method for swapping a message or value of one to another.
3. Design location method for display the node location position using (x, y) coordinate also display next node position(dx,dy).
4. Design construct graph method which create or draw new graph of connecting all node Using NAV mechanism in new construction.
   If NAV != 0 then channel is busy and go to power saving mode.
   else then node sense RTS for data sending.

5 while (connected node ()! =MAX_NODE)
   { // construct again //
   Repeat step 3
   Repeat step 4
   Repeat step 5
   }

6 Design clock method
   Node[i].clock>node[j].clock
   if satisfy then swapping value and every time value of i is changed.

7 Design movement method using angle for find new position and using speed for find value of node.

8 Initialize node value
   show node power saving state, packet value, visited node, maximum node battery power, power consumption.
   Repeat step 7

9 Design Simulation method for generating output
   Initialize variable and different sender, receiver, idle, sleep state.
   survive=MAX_NODE;
   checking state is idle or not broadcast the data.
   Comparing the value of BI>(BW+MW))
   For switching mode.
   Because we are changing value of
   BI = Beacon Interval length
   BW = Beacon Window
   MTIM = Multihop transmission indication map.

10 Display total used power of Node
   total=total + node[i].usedpower.
   total=total/MAX_NODE.

11 Output generated such as route, simulation time, survival rate.

12 Close a file
   fclose(fp);

***Simulation Parameters***

| | |
|---|---|
| Node Density | 50, 100, 150, 200, 250, 300 |
| Area | 1000*1000 $m^2$ |
| Routing Protocol | AODV |
| Power Capacity | 100 Joule |
| Radio Propagation Range | 250 m |
| Channel Capacity of each node | 2 Mbits/sec |
| Packet Length | 1024 bytes |
| Mobility Model | Random way point |
| Pause Time | 20sec |
| Mobility Speed | 0, 5, 10, 20, 30, 40, 50 ms |
| Default Mobility Speed | 5 ms |
| Beacon interval Length | 100, 200, 300, 400 ms |
| Default Beacon interval Length | 100 ms |
| Beacon Window | 2, 4, 8 ms |
| MTIM | 8, 16, 32 ms |

***Results Analysis***

**Comparison various Parameters of Protocol**

**1. 50 node density and various mobility speed**

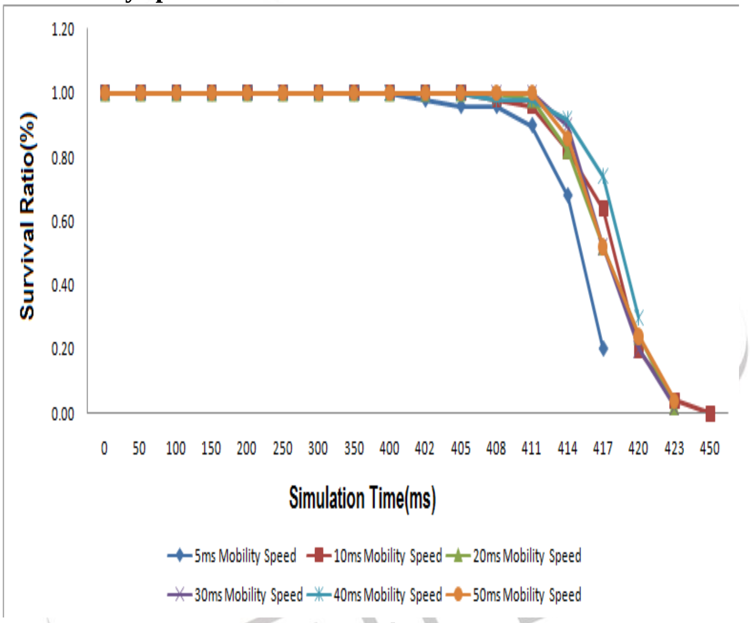



Fig. BW 2ms and MTIM 8ms

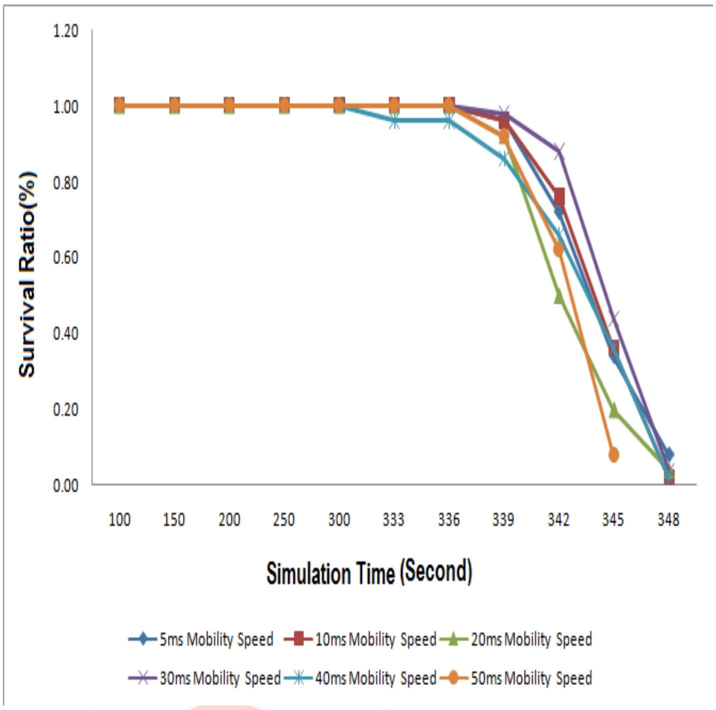



Fig. BW 4ms and MTIM 16ms

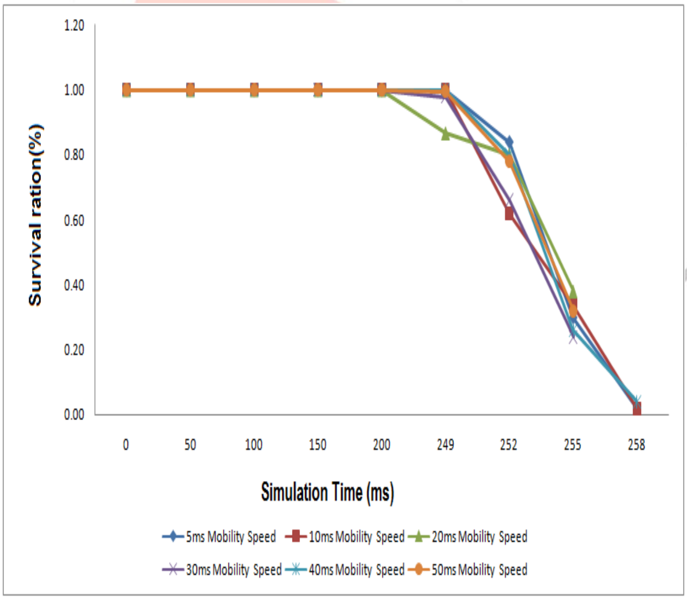



Fig. BW 8ms and MTIM 32ms

In this section we are taking node density is 50, various mobility speed and beacon interval length is 100ms. Also we are using various BW & MTIM value like 2, 4, 8ms & 8, 16, 32ms. So that from above figure we are conclude that when we increase in BW & MTIM value simulation time decreases, survival ratio increase and average power consumption decreases comparing with value like 8-32 ms with 4-16ms and 2-8ms. Same as when we decrease in BW & MTIM value simulation time increase, survival ratio decreases and average power consumption increase comparing with value like 2-8 ms with 4-16ms and 8-32ms.

**2. 200 node density and various mobility speed**

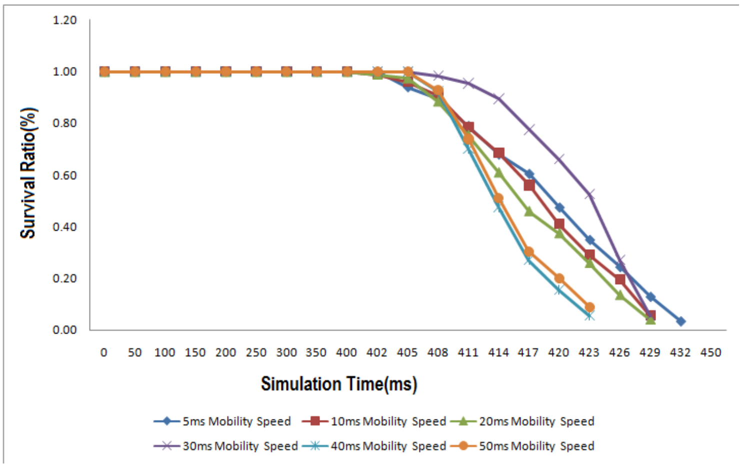



Fig. BW 2ms and MTIM 8ms

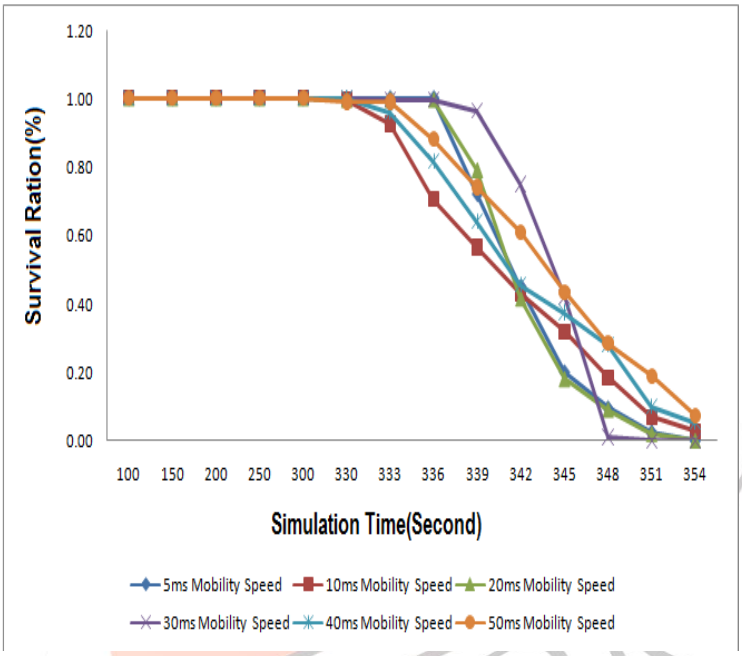



Fig. BW 4ms and MTIM 16ms

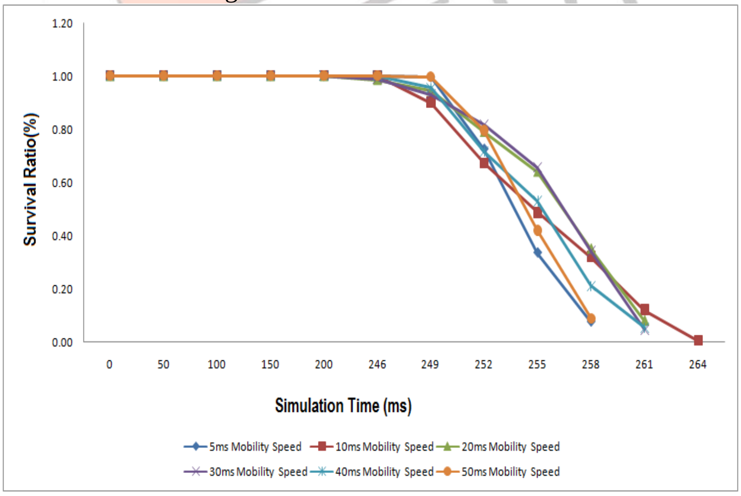



Fig. BW 8ms and MTIM 32ms

In this section we are taking node density is 200, various mobility speed and beacon interval length is 100ms. Also we are using various BW & MTIM value like 2, 4, 8ms & 8, 16, 32ms. So that from above figure we are conclude that when we increase in BW & MTIM value simulation time decreases, survival ratio increase and average power consumption decreases comparing with value like 8-32 ms with 4-16ms and 2-8ms. Same as when we decrease in BW & MTIM value simulation time increase, survival ratio decreases and average power consumption increase comparing with value like 2-8 ms with 4-16ms and 8-32ms.

**3. 100 node density and various BI length**

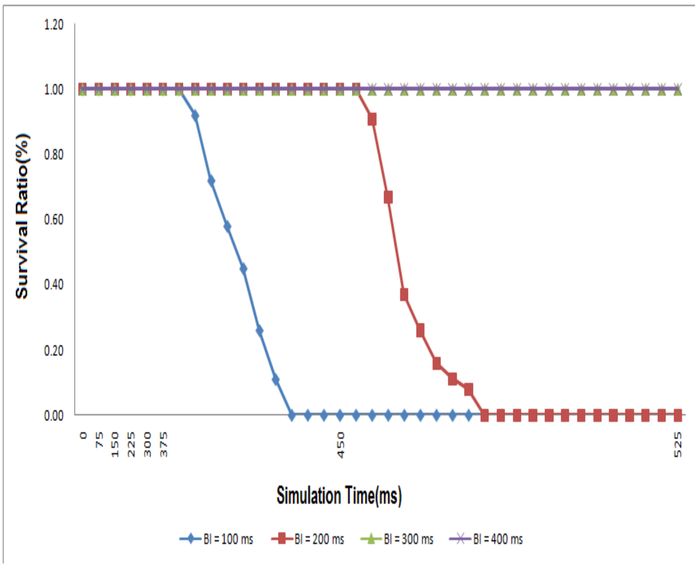



Fig. BW 2ms and MTIM 8ms

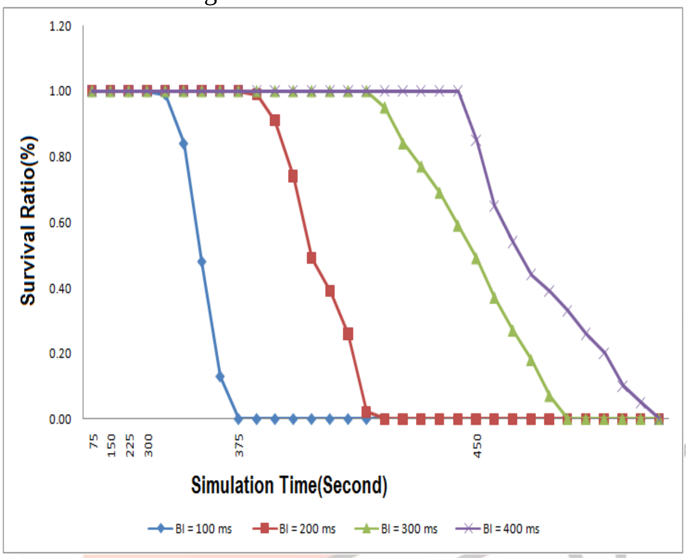



Fig. BW 4ms and MTIM 16ms

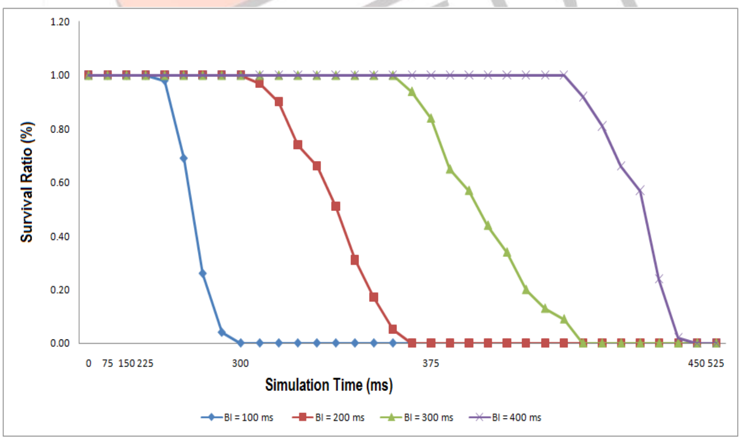



Fig. BW 8ms and MTIM 32ms

In this section we are taking node density is 100, mobility speed is 5ms and various beacon interval length like 100ms, 200ms, 300ms, and 400ms. Also we are using various BW & MTIM value like 2, 4, 8ms & 8, 16, 32ms. So that from above figure we are conclude that when we increase in BW & MTIM value simulation time decreases, survival ratio increase and average power consumption decreases comparing with value like 8-32 ms with 4-16ms and 2-8ms. Same as when we decrease in BW & MTIM value simulation time increase, survival ratio decreases and average power consumption increase comparing with value like 2-8 ms with 4-16ms and 8-32ms. But in 2ms BW & 8ms MTIM value and 300 & 400ms value of BI node doesn't go in dead state it always in wake up state so that survival ration value is always 1 as shown in fig.

**4. 150 node density and various BI length**

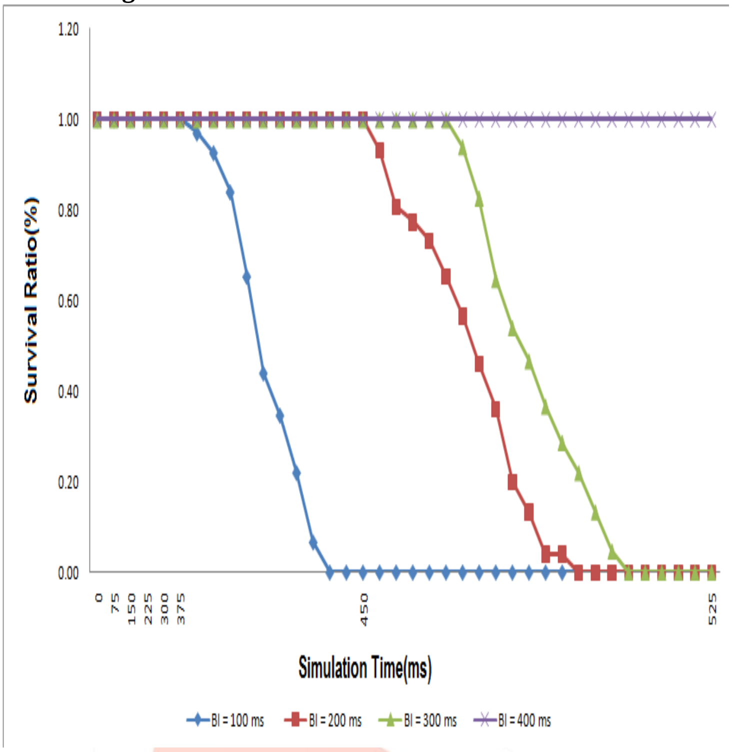



Fig. BW 2ms and MTIM 8ms

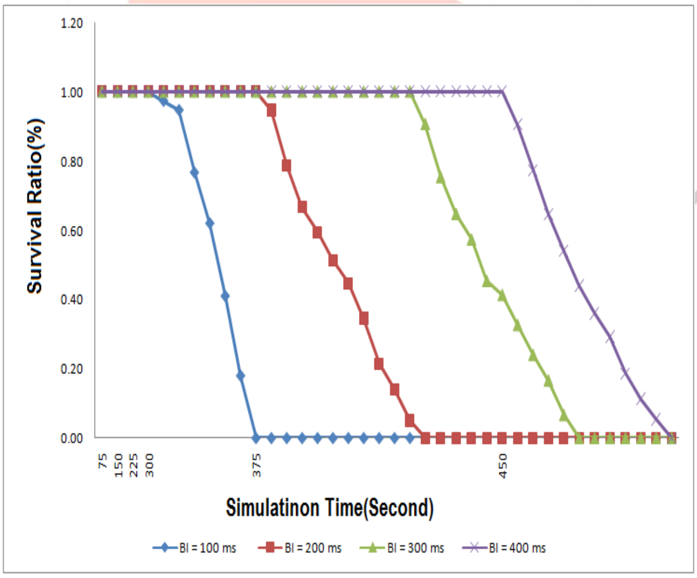



Fig. BW 4ms and MTIM 16ms

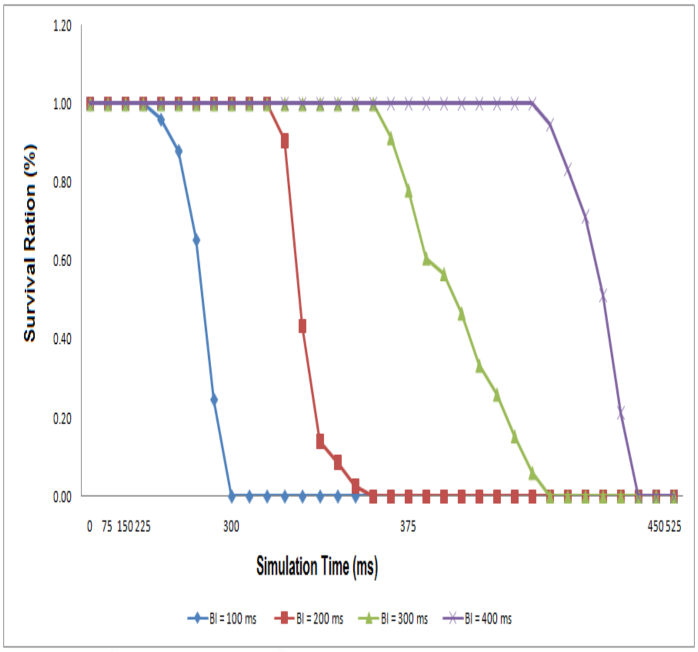



Fig. BW 8ms and MTIM 32ms

In this section we are taking node density is 150, mobility speed is 5ms and various beacon interval length like 100ms, 200ms, 300ms, and 400ms. Also we are using various BW & MTIM value like 2, 4, 8ms & 8, 16, 32ms. So that from above figure we are conclude that when we increase in BW & MTIM value simulation time decreases, survival ratio increase and average power consumption decreases comparing with value like 8-32 ms with 4-16ms and 2-8ms. Same as when we decrease in BW & MTIM value simulation time increase, survival ratio decreases and average power consumption increase comparing with value like 2-8 ms with 4-16ms and 8-32ms. But in 2ms BW & 8ms MTIM value and 400ms value of BI node doesn't go in dead state it always in wake up state so that survival ration value is always 1 as shown in fig.

**5. 200 node density and various BI Length**

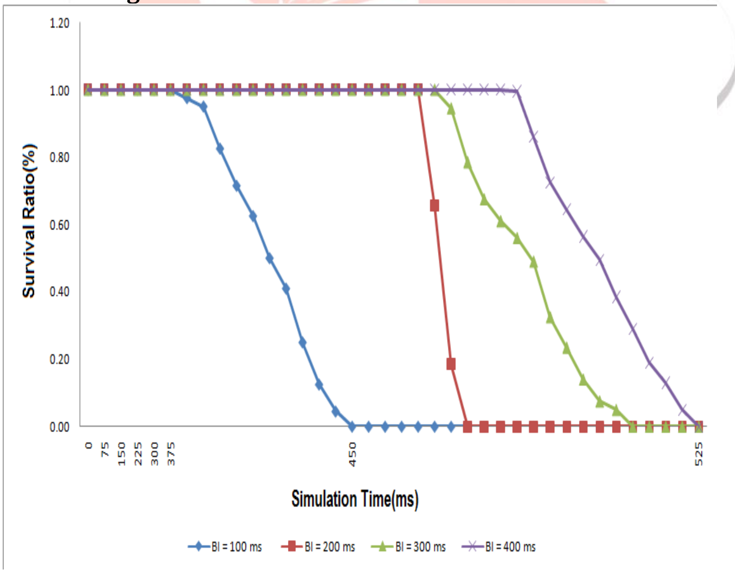



Fig. BW 2ms and MTIM 8ms

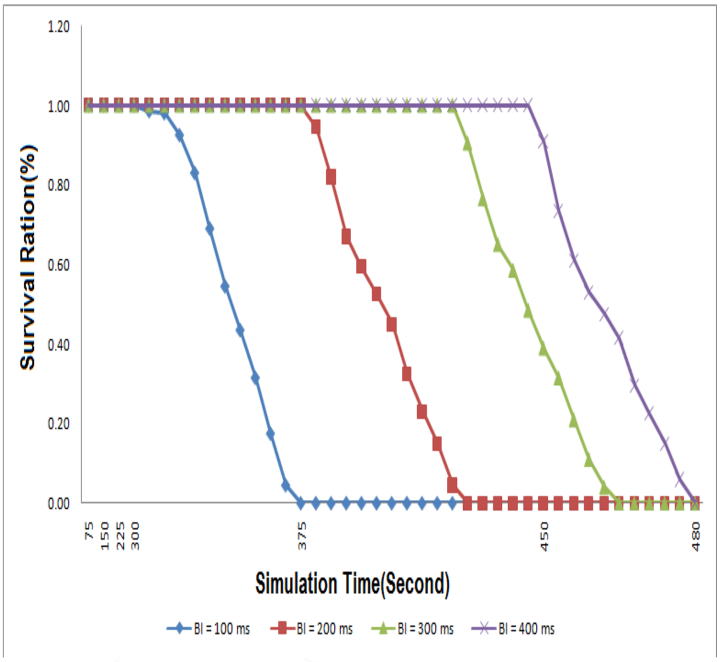



Fig. BW 4ms and MTIM 16ms

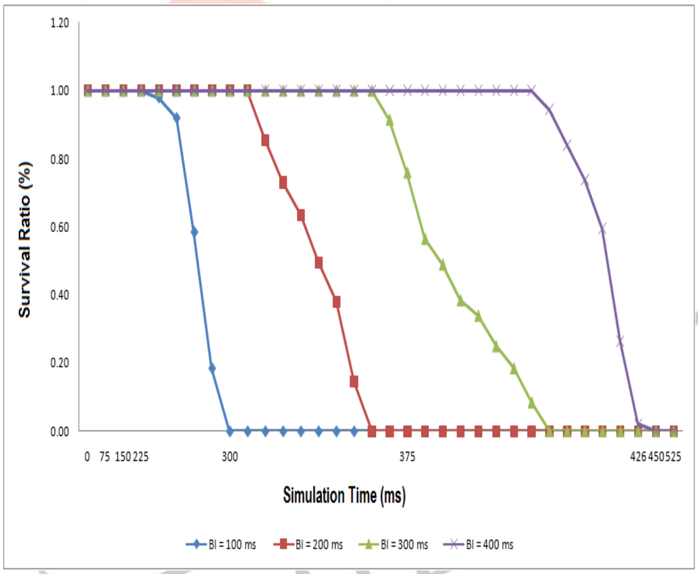



Fig. BW 8ms and MTIM 32ms

In this section we are taking node density is 200, mobility speed is 5ms and various beacon interval length like 100ms, 200ms, 300ms, and 400ms. Also we are using various BW & MTIM value like 2, 4, 8ms & 8, 16, 32ms. So that from above figure we are conclude that when we increase in BW & MTIM value simulation time decreases, survival ratio increase and average power consumption decreases comparing with value like 8-32 ms with 4-16ms and 2-8ms. Same as when we decrease in BW & MTIM value simulation time increase, survival ratio decreases and average power consumption increase comparing with value like 2-8 ms with 4-16ms and 8-32ms.

**6. Neighbor Discovery Time for various node density and various BI length**

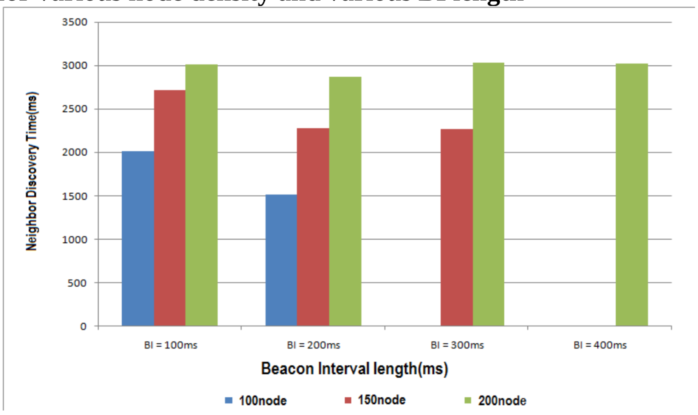


Fig. BW 2ms and MTIM 8ms

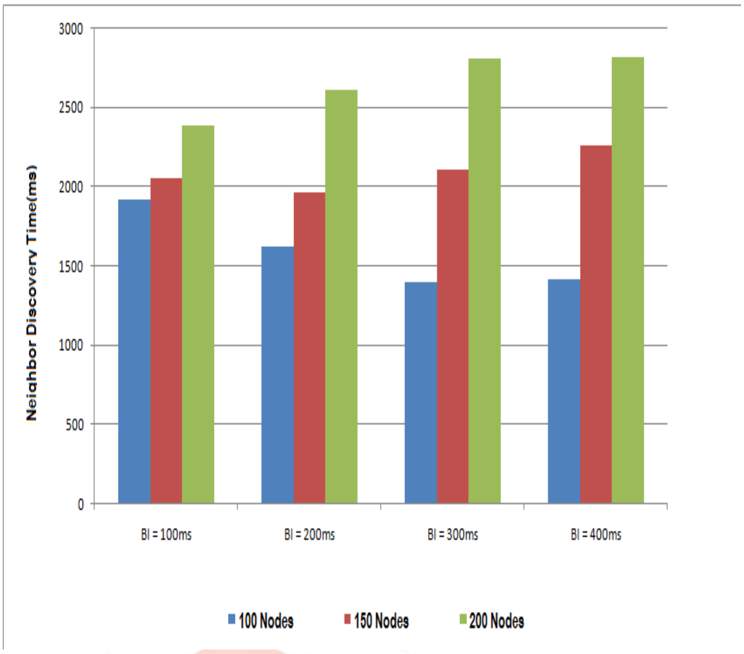



Fig. BW 4ms and MTIM 16ms

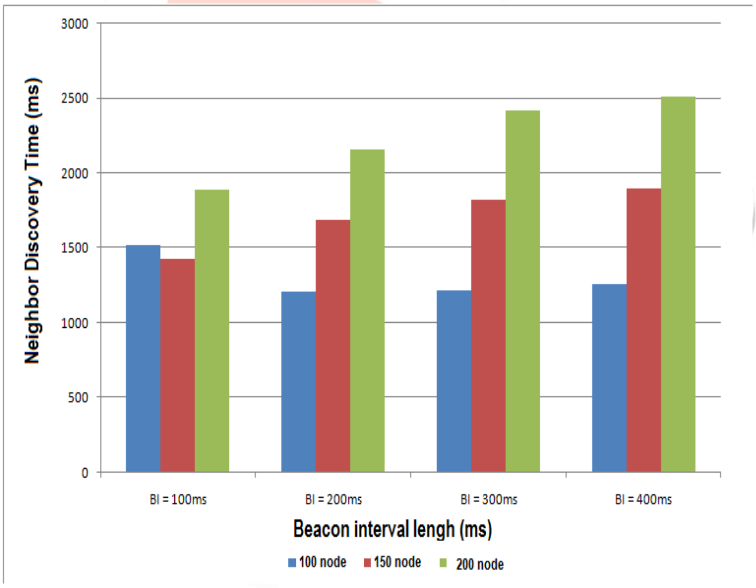



Fig. BW 8ms and MTIM 32ms

In this section we are taking various node density like 100, 150, and 200, mobility speed is 5ms and various beacon interval length like 100ms, 200ms, 300ms, and 400ms. Also we are using various BW & MTIM value like 2, 4, 8ms & 8, 16, 32ms. So that from above figure we are conclude that when we increase in BI & node density value at simulation time the neighbor discovery time is increase. So the survival ratio is decrease and average power consumption is increase.

**7. Neighbor Discovery Time for various mobility speed**

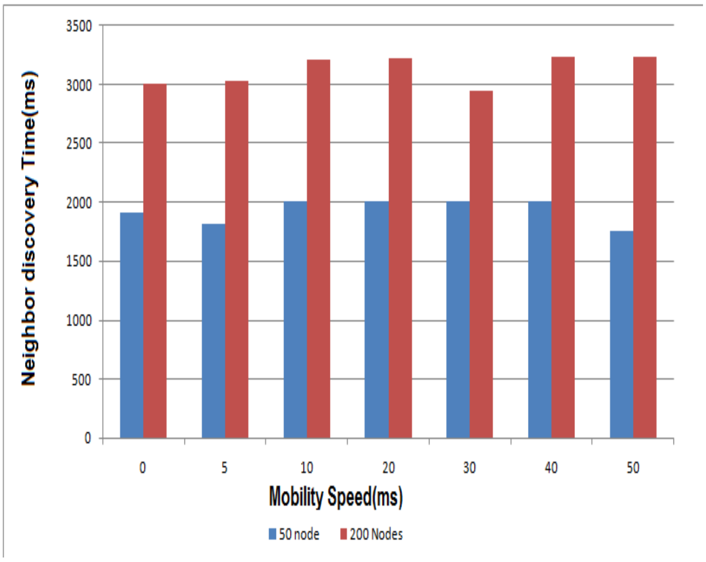



**Fig. BW 2ms and MTIM 8ms**


Fig. BW 4ms and MTIM 16ms

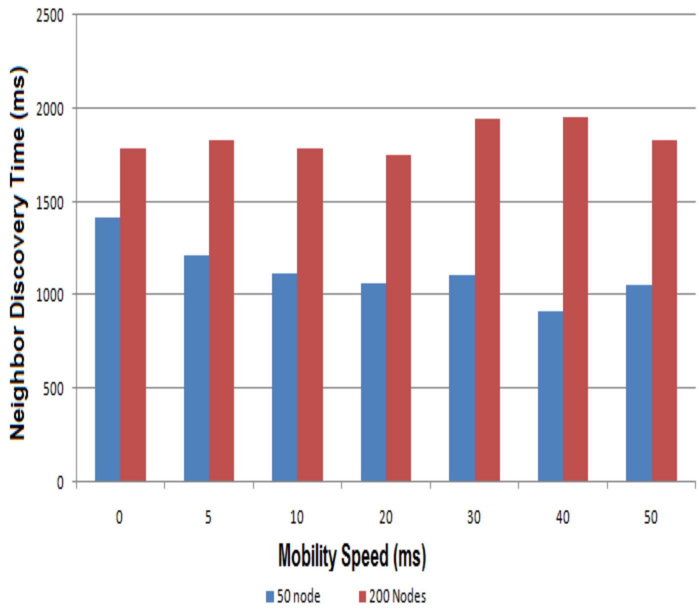
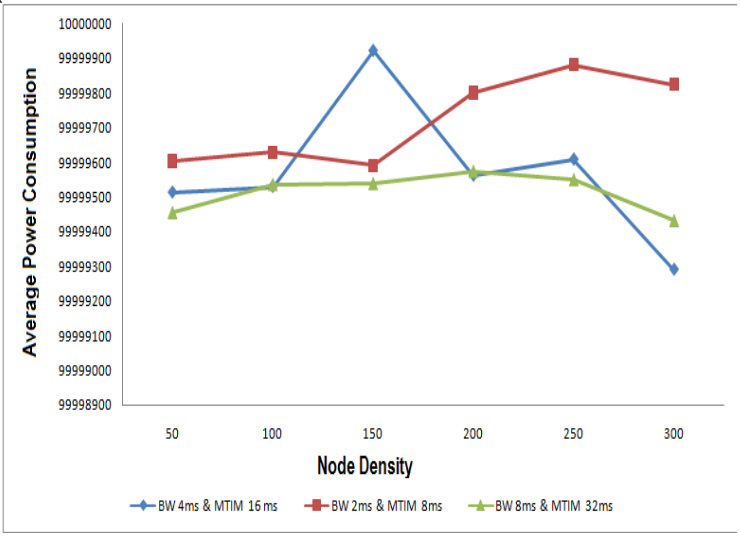



Fig. BW 8ms and MTIM 32ms

In this section we are taking various node density like 50 and 200, various mobility speed and beacon interval length like 100ms. Also we are using various BW & MTIM value like 2, 4, 8ms & 8, 16, 32ms. So that from above figure we are conclude that when we increase in mobility speed & node density value at simulation time the neighbor discovery time is increase. So the survival ratio is decrease and average power consumption is increase.

**8. Average Power Consumption with various BW & MTIM window**




In this section we are taking various node density like 50, 100, 150, 200, 250 and 300, mobility speed is 5ms and beacon interval length like 100ms. Also we are using various BW & MTIM value like 2-8ms, 4-16ms & 8-32ms. So that from above figure we are conclude that when we are comparing the value of average power consumption for various beacon window and multihop transmission indication map so that increase in BW & MTIM value average power consumption decrease because we are increasing the node density and area of boundary the intermediate node or router node increase so they consume more power and more time.
So I prove that my new work is better then oldest p-manet work.

## IV. Conclusion and Future Work

we can conclude that when the simulation time increase then average power consumption also increase and survival ratio is decrease. But the simulation time decrease then average power consumption also decreases and survival ratio is increase. In this p-manet protocol author bound boundary to take fix values of BW and MTIM like 4&16ms so we are taking the three BW & MTIM value like 2&8ms, 4&16ms, 8&32ms and all this three value the 8-32ms value is better then the other two value in comparing different parameter like average power consumption, mobility speed, neighbor discovery time, survival ration, node density, simulation time.

For future work we can design a new protocol using Time synchronization approach and Best path selection in multiple path using NAV with range of node and energy.

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