Spectrum Aware PSNR Based Hand-off for Seamless Multimedia Streaming in Dense MANET

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Abstract- **It is difficult to serve mobile users in dense MANET (Mobile Ad-hoc Network) by selecting traditional infrastructure of Ad-hoc networks. In this paper, we proposed new relay based technology to handover from old relay node to new relay node. For this purpose, we use implementation of ad-hoc mobile nodes with radio channel in MatLab platform by multimedia data i.e. Image. We have simulated this scenario against RSSI (Received Signal Strength Indication) and PSNR (Peak to Signal Noise Ratio) by considering more than 15 mobile nodes. Based on RSSI and PSNR values, we have decided the threshold to handover to the new relay node from old relay node. In this way, we have saved the bandwidth and spectrum as well as we noticed there is increase in multimedia data throughput with less congestion in network.**

Index Terms— **MANET, Ad-Hoc RSSI, PSNR, Handover,**

I. INTRODUCTION

The increasing availability of wireless devices and heterogeneous wireless technologies opening new market opportunities to provide entertainment and seamless multimedia services for mobile user. Anytime and anywhere access to internet services, while moving across different wireless infrastructures, is a common requirement for many users. Due to common requirement of many user traffic is occur in MANET [1]. In some areas of moutons and hills MANETS don't give requirement of user such as location updating services. However, the flat routing protocols such as Dynamic Source Routing (DSR) and Ad-Hoc On demand Distance Vector Routing (AODV) may not be able to handle a large scale ad hoc network, especially when the density of mobile hosts in a network is high[9]. More recently, the industry has started looking into offering location dependent services to enrich user experiences in (generally public) pervasive computing environments, with seamlessly tailored content delivery that depends on the client position. Such services present technical challenges as well as provisioning opportunities when applied to highly populated regions, where there's a need to distribute specific content to geographically bounded areas of interest (AOIs) that typically change at provisioning time. For example, a business fair's advertisement service might transmit different and AOI-dependent promotional videos only in highly populated parts of an exhibition area. The content would depend on the current and applicable context of the targeted pervasive environment considering, for example, nearby exhibitors. However, the development and deployment of these multimedia services is challenging, owing to typically strict quality-of-service (QOS) requirements for the data arrival time as well as data jitter and packet losses. In addition, densely populated spots tend to be intrinsically dynamic and short-termed, and they can change rapidly and unpredictably [1].

This makes it difficult and costly to plan and deploy in advance the network and provisioning infrastructures needed to grant accurate scalable delivery of continuous services in the specific spatial portions that will temporarily become dense AOIs. Moreover, node mobility typical of dense mobile ad hoc networks (MANETS) further exacerbates these issues, especially the seamless provisioning of continuous flows and effective identification and management of AOIs with limited overhead and sufficient promptness .Therefore spectrum aware PSNR based hand-off management is essential.

Paolo Bellavista et. all proposed location dependent services to enrich user experiences in (generally public) pervasive computing environments, with seamlessly tailored content delivery that depends on the client position by considering the parameter of RSSI(Received Signal Strength

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Indication)[1]. To ensure data continuity throughout the relay handoff management process.

Zhang-Xin Chen, He-Wen Wei, et all (2009) first proposed that the classical MDS algorithm is feasible for the mobile localization. Then they show that all MDS-based algorithms can be unified under the same framework and they are not optimal according to the Gaussian Markov theorem[2].

P. Bellavista, Senior Member IEEE et.all (2009) proposed three main contributions. First, it proposes a simple way to specify handoff-related service-level Objectives that are focused on quality metrics and tolerable delay. Second, it presents how to automatically derive from these objectives a set of parameters to guide system-level configuration about handoff strategies and dynamic buffer tuning. Third, it describes the design and implementation of a novel handoff management infrastructure for maximizing streaming quality while minimizing resource consumption[3].

In this paper (4) Supeng Leng, Member, IEEE et.all (2009) proposed a novel k-hop Compound Metric Based Clustering (KCMBC) scheme, which uses the host connectivity and host mobility jointly to select cluster-heads. Simulation results show that the clusters created by using the KCMBC approach retain modest but more uniform cluster size, and cluster-head life-time can be increased by KCMBC up to 50%.

Shivajit Mohapatra, Nikil Dutt, et. all proposed the design and implementation of a cross-layer framework for evaluating power and performance tradeoffs for video streaming to mobile handheld systems. They have implemented cross-layer framework (called DYNAMO) and evaluated it on Compaq iPaq running Linux using streaming video applications [5].

Hsien-Po Shiang and Mihaela van der Schaar(2007) proposed solution is a low-complexity, distributed, and dynamic routing algorithm, which relies on prioritized queuing to select the path and time reservation for the various packets, while explicitly considering instantaneous channel conditions, queuing delays and the resulting interference. Their results demonstrate the merits and need for end-to-end cross-layer optimization in order to provide an efficient solution for real-time video transmission using existing protocols and infrastructures[8].

In this paper (10) Abderrahim Benslimane, Senior Member, IEEE, Tarik Taleb, proposed Coupling the high data rates of IEEE 802.11p-based VANETs and the wide coverage area of 3GPP networks (e.g., UMTS), this paper envisions a VANET-UMTS integrated network architecture. Encouraging results are obtained in terms of high data packet delivery ratios and throughput, reduced control packet overhead, and minimized delay and packet drop rates.

Paolo Bellavista, Antonio Corradi, et. all proposed lightweight autonomic dissemination of entertainment services that exploits impromptu collaborations among mobile wireless peers to replicate resources in an efficient and lazily consistent way. REDMAN implements novel lightweight solutions to identify dense MANETs.[11].

In this paper (12) Jin-Woo Kim, Kyeong Hur, Jongsun Park, and Doo-Seop Eom proposed a new DRP reservation scheme using a new 2-hop range DRP Availability IE for three-hop mobility support in WUSB networks with ultra wideband (UWB) technology. It is shown by simulation results that throughputs of devices at frequent three-hop range DRP reservation conflicts are largely increased.

A. Bruce McDonald, Student Member, IEEE, et. all they proposed a novel framework for dynamically organizing mobile nodes in wireless ad hoc networks into clusters in which the probability of path availability can be bounded. The purpose of the (α; t) cluster is to help minimize the far-reaching effects of topological changes while balancing the need to support more optimal routing[13].

Ralf Pabst, Bernhard H. Walke, and Daniel C. Schultz author proposed different approaches to exploiting the benefits of multihop communications via relays, such as solutions for radio range extension in mobile and wireless broadband cellular networks (trading range for capacity), and solutions to combat shadowing at high radio frequencies.

ISSN: 2278 – 1323

They also shown that through the exploitation of spatial diversity, multihop relaying can enhance capacity in cellular networks[14].

In this paper(15)Xin Ming Zhang, Member, IEEE, En Bo Wang, et.all proposed an estimated distance (EstD)-based routing protocol (EDRP) to steer a route discovery in the general direction of a destination, which can restrict the propagation range of route request (RREQ) and reduce the routing overhead. In the EDRP, the change regularity of the received signal strength indication (RSSI) is exploited to estimate the geometrical distance between a pair of nodes, which is called the estimated geometrical distance (EGD).

II. SYSTEM MODEL.

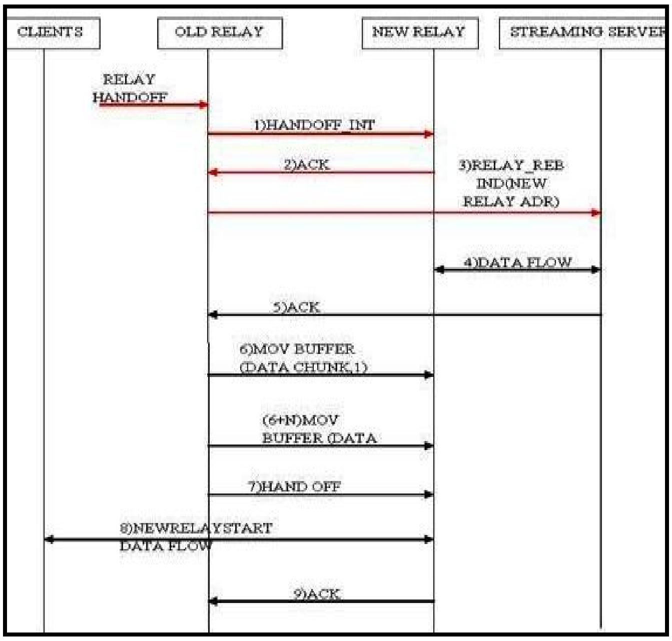

Fig.1 Hand-off management process for spectrum aware PSNR.

The handoff management procedure starts by following steps:

1) When the old relay request HANDOFF_INIT message to the new relay.
2) New relay reply ACK signal to old relay.
3) Old relay to elect new relay and rebinds the server to the new relay address.
4) Data flow from server to new relay.
5) Server reply ACK signal to old relay.
6) Old relay move data to new relay.
7) Hand-off process start from old relay to new relay.
8) New relay start data flow to client.
9)When data flow start from new relay to client then new relay reply ACK signal to old relay.

III.IMPLEMENTATIONOF MOBILE NODES IN MATLAB ENVIRONMENT

Nodes Location

Firstly the number of nodes of numeric type data is taken from edit box from the GUI. The default number of node is taken as 20 nodes. The node location is taken as random. X-axis and Y-axis location for each node is taken as random number. As many as the number of nodes, the random numbers are generated using ***rand*** function in MATLAB.

Node Customization

The movement, distance and direction for each node are customized as per the user requirement. There are two customizations; one is default table in which the first 5 nodes out of 20 nodes are movable. The distance and direction is taken as default. The other one is the customization; in which the table containing 4 columns and 20 rows appear. Checkmark the nodes you want to move along the distance and direction (left, right, up, down).

Node Movements

From the table of customization, the respective node location is changed. If the node direction is selected as left, then the nodes X-axis coordinate is incremented keeping its Y-axis constant till the distance mentioned. If the node direction is selected as right, then the nodes X-axis coordinate is decremented keeping its Y-axis constant till the distance mentioned. If the node direction is selected upwards, then the nodes Y-axis coordinate is incremented keeping its X-axis constant till the distance mentioned. If the node direction is selected as downward, then the nodes Y-axis coordinate is decremented keeping its X-axis constant till the distance mentioned.

Plotting Nodes

The Nodes are plot in Mat lab using ***plot*** function.
The appearance of nodes is done by changing the properties of the plot: line-width, color, marker-size, marker-face-color, marker-edge- color, etc. The node number is printed by giving each node location to ***text*** function in Mat lab.

Radio Channel

Application Layer

This plays very important role for this simulation it performs the application as per our requirement. In this, the nodes transmission and reception according to our application

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is performed. There are 8 cases: Initialization, Packet_sent, Packet_recieved, Packet_collision, clock_Tick, GuiInfoRequest, Application_stoped, Application_finished.

Initialization, each and every node is initialized, the memory for each node is allocated here, differentiate the base station, router, and sensor nodes.

Packet_sent, when the packet transmission ends in the MAC layer, then this function is called. It performs the operations to be controlled after the packet is sent from particular node.

Packet_Recieved, when the packet Packet_Recieved_End function from the radio channel MAC layer, this fuction is called. It performs the operations to be controlled after the packet is received at base station or routers. Here the acknowledgement is sent back to transmitted node .

Packet_collision, if the packet is collided this function is called, through this function a packet can be retransmitted to the destination.

Clock_Tick, this function is called at each clock instant. If the application changes according to time instant then this function is called.

GuiInfoRequest, this function is called when we click on the particular mote, it displays the memory dumped for that particular node on the command window.

Application_stoped, this function is called when the simulation is stoped. Here we have plotted the graph for energy consumption, delay, reliability and Packet delivery ratio.

Application_finished, this function is called when the simulation gets finished.

Animation; There are several events occur on the particular node during simulation. These events are shown in the graph by animation file. The events are: Init_Application,Packet_Sent, Packet_Received, Collided_Packet_Received, Clock_Tick, Channel_Request, Channel_Idle_Check,Packet_Receive_Start,Packet_Receive_ End, Packet_Transmit_Start, Packet_Transmit_End.

Certain colors are assigned for particular event: red, green and yellow.

STEPS OF SIMULATIONS

While implementing the mobile nodes in mat lab Following steps are done

1) Select type of node i.e. stationary or mobile node
2) Mention number of mobile nodes and transmission range
3) Click on plot button
4) Select node movement i.e. default or customization after that mobile node customization table will open.
5) Click on start button simulation to start and click on stop button simulation to stop.

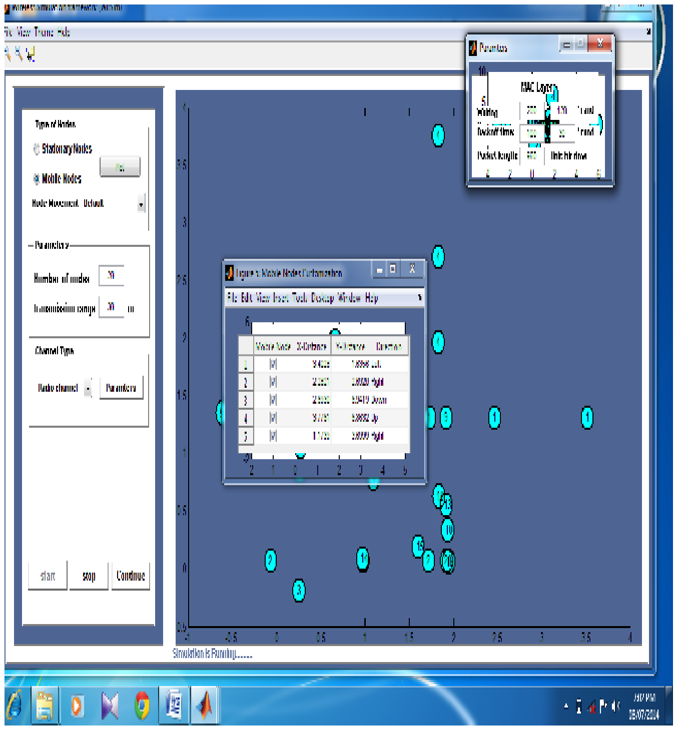

Fig.2 Steps of simulation

IV. IMPLEMENTATION OF RSSI AWARE HANDOVER

Distance calculation between transmitting and receiving node When the simulator starts the distance between transmitting node and receiving node is calculated using Euclidean distance. In MATLAB 'pdist' function is used to calculate the distance.

PSNR calculation

PSNR is calculated between the transmitted image and the received image the memory is declared for each node, it contains message to be transmitted, last transmitter ID and the RSSI value of that node. The image in MATLAB is read using imread function, this image is send as message by transmitting node. Finally the PSNR is calculated at receiver node between received image and transmitted image

$$PSNR = 10 \log_{10}\left(\frac{R^2}{MSE}\right)$$

Where, $MSE = \frac{\sum_{m,n}[I_1(m,n) - I_2(m,n)]^2}{M*N}$,

I1 = received image by the receiver, and I2 = transmitted image

R=maximum fluctuation in the image,

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M and *N* are the number of rows and columns in the input images.

RSSI Calculation

The variance of the radio transmission signal strength is user defined in the radio channel property. The topology of nodes is also considered. The RSSI is calculated as

RSS =transmitted signal strength *Position of node * variance of the radio transmission signal strength

Time	Event	NodeID	Distance	RSSI	PSNR
0.06	Packet_Transmit_End	2	Tx node	1.00	
0.06	Packet_Received	1	0.99	0.69	65.73
0.06	Packet_Received	3	1.08	0.61	64.36
0.06	Packet_Received	4	1.70	0.18	63.37
0.06	Packet_Received	5	2.17	0.13	63.27
0.06	Packet_Received	6	1.43	0.33	63.69
0.06	Packet_Received	7	1.18	0.21	63.41
0.06	Packet_Received	8	0.87	0.84	68.09
0.06	Packet_Received	9	0.23	0.97	76.14
0.06	Packet_Received	10	0.57	0.79	67.02
0.06	Packet_Received	11	1.20	0.71	65.91
0.06	Packet_Received	12	1.49	0.46	64.07
0.06	Packet_Received	14	0.96	0.36	63.76

Figure: 3, Comparison of RSSI and PSNR value.

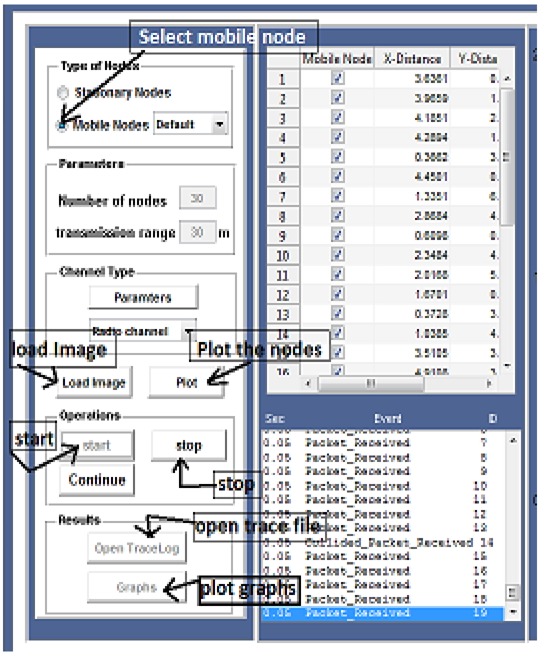

Figure: 4, Spectrum aware PSNR VALUE

V. SPECTRUM AWARE PSNR

For the relay handoff prediction the following steps occur:

The area of interest is found from the topology of nodes plotted. It is calculated by the finding Euclidean distance between each and every node. The node in dense area has minimum distance from each and every node, so the minimum distant node is taken as old relay.

1. Initially all the nodes are initialized and the Relay node gets in Packet Transmit Start mode all the other nodes get in packet receive start mode.
2. The Relay node starts transmitting the image data one by one.
3. Once the Packet Transmit End mode is assigned by relay node other nodes receive the data and the PSNR between the transmitted data and received data is calculated.
4. When all the nodes are in Packet Received End mode again all the nodes retransmit the PSNR value calculated to the old relay node.
5. Now the relay node acknowledges the node with higher PSNR and RSSI as the new relay.
6. The new relay receives the acknowledgement and start transmitting the data to the other nodes. And the process continues.

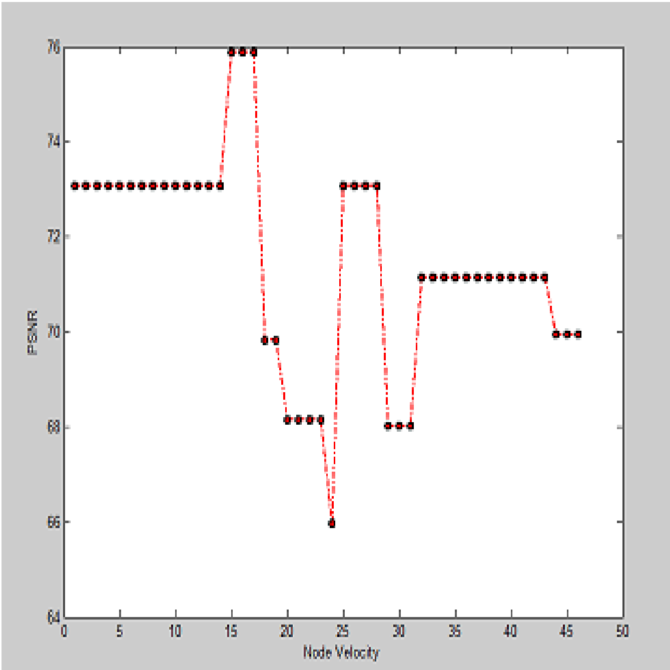

Figure: 5, Node velocity verses PSNR characteristic

ISSN: 2278 – 1323

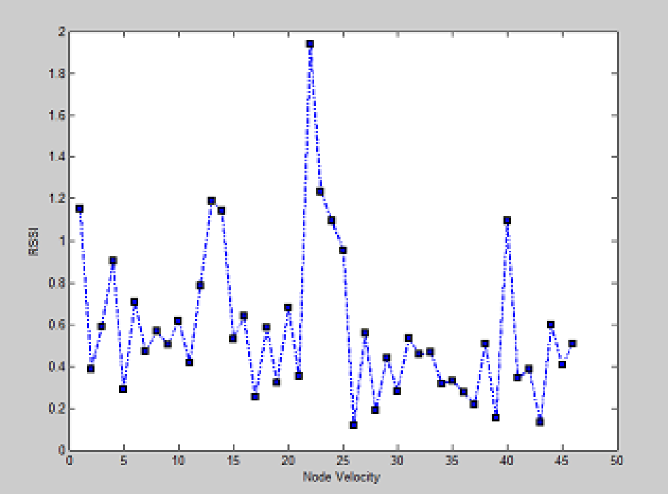

Figure: 6, Node velocity verses RSSI characteristic

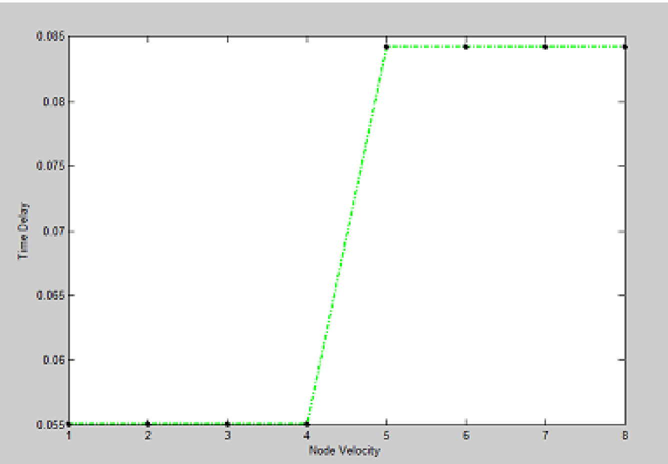

Figure: 7, Node velocity verses time delay characteristic

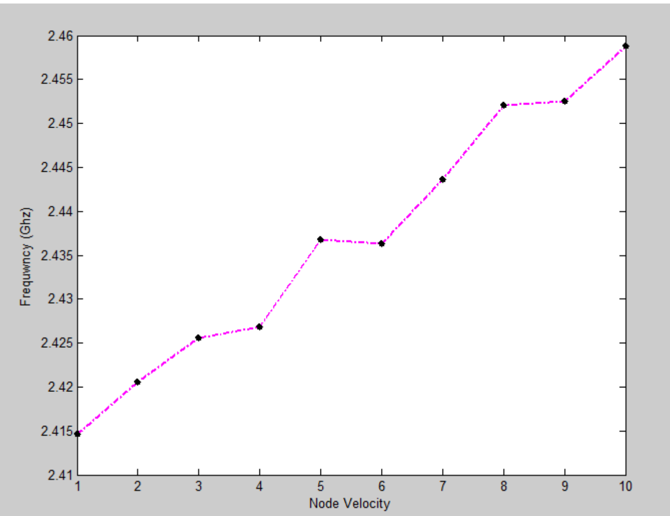

Figure: 7, Node velocity verses Frequency characteristic

VI. CONCLUSION

In this work we study, how throughput, effective bandwidth utilisation and spectrum utilisation improvement in dense MANET. Also we study how to avoid traffic congestion and provide good quality of service to mobile users.

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