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Energy Efficient and Cluster Based Multi-Hop Routing Of Nodes in LTE

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Abstract : Present day cellular networks, including Long Term Evolution (LTE) networks, suffer as of the augment in the quantity of user gadgets linked with the network in a region. Routing is an essential procedure to course the data packets as of the source to destination node in any network. Thus there stands a requirement for the algorithm to decide the most ideal approach to exchange the data. Yet, the nodes nature with restricted batteries is the key constraining variables which diminishes the life expectancy of the nodes. Multi-Hop (MH) systems are favored in long-range broadcast. Though MH limits the measure of energy price devoured by every node all through the path yet finding the ideal routing path betwixt nodes is as yet difficult. Here, proposed a method in which the node's energy in the LTE network is effectively used with the assistance of cluster centered approach is the energy efficient cluster based multi-hop routing (EECMR). This strategy gives extraordinary enthusiasm to the node's residual energy; henceforth higher energy nodes are only chosen to work as relays. Additionally, the aggregate energy consumption at transmission in addition to reception has been converged to model the weight of links betwixt nodes. As the weight of edges augments, the quantity of hops diminishes. Henceforth, the long-hop transmission is accomplished and the aggregate energy consumption is limited. The proposed work beats the other traditional strategies is exhibited from the Simulation outcome.

Keywords-D2Dcommunication,Energy Consumption, Long Term Evolution, Long-Hop Transmission, Multi-Hop Routing Techniques, Optimal Routing Path.

I. INTRODUCTION

The unprecedented enlargement in cellular phones along with applications has set off a blast in the data traffic. To meet the surge in the traffic volume, merchants and administrators are investigating each tool close by to ameliorate the spectrum competence and network capacity [1]. Methods for communications offer an incredible open door for clients of these systems to expect completely their part as people on call, with a superior appraisal of the realities, through powerful and incessant access to data. Luckily, LTE networks could give extra resources. In reality, it shares commercial radio resources for basic access to commercial users and users of public protection [2]. LTE is the principal technology to be outlined unequivocally for the Next Generation Network (NGN) and is set to wind up the de-facto NGN mobile access network standard. LTE, intended to expand the limit and speed of mobile networks, utilizes Orthogonal Frequency Division Multiple Access (OFDMA) intended for the downlink and also the Single Carrier-FDMA (SCFDMA) aimed at the uplink [3].

New developing wireless access technologies, for example, LTE is Internet Protocol (IP) centered cellular mobile networks, has expansive application prospects and market potential. In this way, the utilization of Mobile IP is unavoidable so as to give mobility support to a mobile node meandering between heterogeneous networks [4]. Since present day communications networks must convey consistently expanding data rates at a regularly diminishing cost per bit, the spatial reuse of the range must be expanded by sending vast number of pico-cells and femtocells. A blend of macro-cells and small cells subsequently prompts the heterogeneous networks advancement, bringing about the expanding intricacy in the configuration and also administration of extensive networks [5]. The present mobile consumer devices are outfitted with the capability to link to the Internet utilizing an assortment of heterogeneous wireless network technologies. During the subsequent some years, the diversity among devices and technologies is anticipated to develop further with, for instance, ascend of all kinds of (possibly mission critical) Internet of Things (IoT) devices and multimedia services [6]. Data traffic in wireless network is developing quickly and this pattern is set to proceed absolutely. Henceforth, wireless broadband networks' throughput requests are confronted with this challenging growth. Besides, the customary homogeneous networks are not ample to ameliorate the clients QoS. Thusly, the Heterogeneous systems or HetNets are viewed as a new technology to manage this issue [7].

The traffic produced by mobile network operators is always developing and by 2020 and it is required to over-burden the current licensed spectrum, prompting a resource scarcity problem [8]. Device to Device communication (D2D) signifies one such technology that conceivably takes care of the capacity bottleneck issue of legacy cellular frameworks. This new paradigm empowers direct collaboration between close-by LTE based gadgets, limiting the data transmissions in the radio access network

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[9]. By misusing the high quality channel of short range links, D2D communication enhances the throughput and the delay. Additionally it enables the gadgets to transmit at diminished power, in this way lessening the energy consumption [14]. Present day cellular networks, including LTE, suffer as of the augmentation in the client gadgets associated with the network in a region. The LTE network-broad performance can be enhanced by setting up additional Base Stations for planned frequency reuse and by increasing more spectrums to suit a greater quantity of users [10]. In particular, the consistent integration of resources into mobile networks is of capital enthusiasm for a few reasons, for example, mobile service extension for rural or low-dense populated situations, expanded backhaul network resiliency or traffic offloading [11].

In the changing scenarios of wireless communications, especially in the mobile ad hoc networks, the node locations change quite frequently. In LTE too, D2D communications stands as a challenging case for routing because the node locations are not fixed when each device works as a node [12]. Routing was solely based on quick data transfer betwixt fixed locations mapped to IP subnets without any dynamic adaptation to moveable objects. Initially, the scope was limited to fast lookup process by matching destination IP against the routing table such as next hop retrieval toward a static location [13]. The rising “mobile Internet” will require new ways to deal with intra- and also inter-domain so as to manage expanded dynamism caused by end-point, network along with service mobility. This take different structure, going as of usual end host mobility along with edge network mobility to multi-homing along with multi-network access related with rising heterogeneous networks [15].

The subsequent of the given paper is ordered as given. Section 2 surveys the associated work regarding the proposed technique. Section 3 elucidates a concise discourse about the proposed technique. Section 4 analyses the experimental outcomes. At last, Section 5 deduces the paper.

II. LITERATURE SURVEY

Yue Wu *et.al* [16] examined how the LTE effectively develop to cater food for new data services by means of using direct communication betwixt mobile phones, furthermore, stretching out the direct transmission to the unauthorized bands, explicitly, D2D communication alongside LTE-Unlicensed. In doing as such, it gave a chance to resolve the fundamental challenge of mutual interference amongst D2D and CC communication. In that unique situation, they looked into three interconnected chief technical territories of multi-hop D2D: transmission band selection, route path selection and resource management. Generally, D2D transmissions were restricted to particular sections of the coverage zone of cell in an attempt to constrain the intrusion to the CC primary links. They demonstrated that by enabling D2D to work on the unlicensed band with proactive fairness measures intended for WiFi transmissions, D2D could work over the entire coverage region and in doing as such, proficiently scaled the general network capacity while limited the cross-level and the cross-technology interference.

Anil Kumar Rangisetti *et.al* [17] tended to the load balance issue by suggesting a unified Software Defined LTE RAN (SD-LTE-RAN) structure and a QoS Aware Load Balance (QALB). Aimed at taking LB choices, the QALB algorithm considered loads of neighbor cells, QoS profiles of UEs and their normal throughputs w.r.t. neighbor cells. Not at all like existing LB algorithms, it doesn't change handover-offset parameters parameters of cells to abstain from ping pong handovers. The suggested structure and QALB algorithm were executed in NS-3 simulator. In different LB situations, suggested QALB algorithm was able to keep up enhanced QoS data rates (>80 % of their designed Guaranteed Bit Rates) intended for over seventy percentage of the cells on the network. Whilst existing LB algorithms were equipped to do alike for just half of the cells on the network. In general, the QALB algorithm was able to diminish the aggregate network overload by 15% contrasted with existing LB algorithms. They additionally assessed the QALB algorithm in mobility situations and recognized that it was able to diminish average network overload by 10% contrasted with existing LB algorithms. To assess the network wide fair load distribution, they characterized load balance index (LBI) utilizing Jain's Fairness Index.

Tzu-Chin Liu *et.al* [18] posited a QoS-aware resource management mechanism for multi-media traffic report frameworks respecting LTE-A (QoS-MTRS). The fundamental thought was to plan resources as specified by the significance degrees of different traffic data. Besides, they mulled over channel accessibility to assure that the transmission was doable. The QoS-MTRS target was to ameliorate the diversity, fulfillment and overall traffic data value under radio resource impediments. They have led a system-level simulation which incorporated a LTE-A network surroundings to evaluate the design. Simulation outcomes demonstrated that the posited QoS-MTRS was superior to BQA (bandwidth and QoS-aware scheduler), Greedy, and FCFS regarding appearance likelihood of receiving in excess of one sort of traffic data types per location block, duplication ratio, overall traffic data value, end-end delay, system throughput, location coverage, and flow rejection rate. The significance was that the posited work could be connected to LTE-A for sustaining high-bandwidth demands IoTs.

Thomas Valerrian Pasca *et.al* [19] in LWIP presented Network Coordination Function (NCF) with a specific end goal to enhance Wi-Fi channel usage by utilizing the capability of LWIP in controlling and planning the transmissions via LTE and also Wi-Fi links. The suggested

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NCF concentrated on organizing the uplink transmissions through Wi-Fi in a network with high load. NCF improved the channel usage of Wi-Fi by managing the packet arrival rate and furthermore by patching up medium access systems at the clients' Wi-Fi interface related with LWIP node. NCF was made out of four distinctive uplink traffic steering algorithms with different targets which enhanced Wi-Fi channel use by (I) limiting collisions among LWIP clients, (ii) expanding transmission opportunities for Wi-Fi clients that are associated with legacy Wi-Fi APs working on a same channel, and (iii) guaranteeing fairness for LWIP along with Wi-Fi clients. Curiously, NCF had enhanced the LWIP client's throughput along with that of Wi-Fi clients. Simulation experiments uncovered that NCF had lessened crashes on the Wi-Fi uplink by 13-53% and enhanced throughput by 10-37% when contrasted with Wi-Fi offloading and Distributed Coordination Function (DCF).

Juho Markkula and Jussi Haapola [20] recommended an ad hoc mode for a LTE-A UE to conquer issues identifying with absence of eNB connectivity for RTUs. The mode was connected to attain a relay node which was the closest UE with base station association. Analytical Markov chain models in addition to a Riverbed Modeler network simulation model were actualized that outlined the performance along with the functionalities while DR traffic was conveyed with differing transmission power levels. A point by point physical layer propagation model intended for D2D communications, a static resource distribution in time domain, hybrid automatic recur request retransmissions, and also a capacity aimed at a UE to get uplink transmissions were modeled analytically and also in the simulator. Both the disjoint analysis and simulations demonstrated that all packets were effectively transmitted at most with the fourth transmission endeavor and also the average network delay was sufficiently low to help majority of the smart grid DR applications (139.2– 546.6 ms).

Esteban Inga *et.al* [21] introduced a scalable route map delineate the minimum cost arrangement of wireless heterogeneous networks which help traffic from the advance metering infrastructure (AMI). They initially investigated the performance of a typical situation in which a solitary technology was utilized to interface smart meters sending traffic to the utility. In view of simulations with actual city maps, they considered the coverage gave to savvy meters by a LTE cell network. With a specific end goal to ameliorate the coverage, an optimization model which considered network capacity along with range was suggested to decide the base stations' ideal site to attain the smart meters' objective coverage. As per those preparatory outcomes with a single access technology, they recommended an evolved network architecture that considered a few options of wireless heterogeneous networks to guarantee the coverage for smart meters with minimal utilization of resources. They presented a heuristic model which included components as of base stations, worldwide data aggregation points, amount of smart meters, and also an ideal routing to attain the desired connectivity as from the smart meters collection. They utilized geo-referenced models to consider actual characteristics of cities and in addition geographical conditions. Results from the advanced model exhibited that by consolidating technologies and utilizing data aggregation points with optimized localizations, the network could accomplish smart meters' target coverage with a decreased cost as far as technological resources. In principle, exploiting direct communication between nearby mobile devices will improve spectrum utilization, overall throughput, and energy efficiency, while enabling new peer-to-peer and location-based applications and services. D2D introduction posses new challenges and risks.

III. ADAPTIVE ENERGY EFFICIENT MULTIHOP ROUTING

LTE stands as a path aimed at cellular communications to work at that high data rate. Routing is a vital task performed to course the data packets as of the source to objective node in any network. Moreover, the node's power resources are significantly limited. Thus, a unique treatment for their accessible energy is profoundly required. MH strategies are favored in long distance broadcast. Although, MH limits the measure of energy cost devoured by every node along the path however finding the ideal routing path betwixt nodes is still exceptionally intriguing issues. The given paper proposes EECMR wherein the node's energy in the LTE network is productively used with the aid of cluster centered approach. The node's average residual energy is utilized as a level of threshold for nodes' classification into low and high-energy nodes. Accordingly, higher nodes can well be solely chosen as relays, where lower ones are not overloaded with any relaying tasks. Consequently, the energy use is balanced. Additionally, this method changes the evaluation index of nodes on the network by increasing the nodes weight to incorporate the transmitting cost, receiving cost, in addition processing cost. As the edges weight increases, the total of hops diminishes. Subsequently, the long-hop transmission can be accomplished as suggested in and the aggregate energy consumption can also be limited.

The technique proposed includes three stages, wherein the preliminary stage is done once and the additional two phases are carried out for every cluster.

- Initialization Phase
- Setup Phase
- Steady State Phase

3.1 INITIALIZATION PHASE

Source node requests towards all the nodes to launch the path in the beginning. Out of the blue, each node responds

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to this request with a control packet to authenticate its presence in the network. This packet encloses the source node's identification number, destination node identification number, location information and the preliminary energy level. BS utilizes the location information to classify these nodes as per their distance as of the base station d_i into G_i, groups where $i = 1,2,....,n.$

The numbers of groups are computed by $d_{\max}$ which stands as the distance of maximum for nodes from BS, in addition the characteristic distance d_{char} as given in equation (1).

$$n = \frac{d_{\max}}{d_{char}} \tag{1}$$

d_{char} is computed utilizing the equation (2).

$$d_{char} = \sqrt{\frac{-y + \sqrt{y^2 - 4xz}}{2x}} \tag{2}$$

If the distance d_i of base station stands larger on considering d_{char}, multiple-hops are used or else direct transfer is preferred. The pseudocode for initialization phase is exhibits in Figure 1.

For all node $v \in V$
If $v == S$
$v_{cost} = 0$
End if
If $E_{RS} \geq E_{average}$
$v_{cost} = \infty$
$v_{Previous} = []$
$v \in Q$
End if
End for

Figure 1: Pseudocode for Initialization Phase

S is the source node, v_{cost} is the tentative cost of the source node, Q is the set of unvisited nodes of explored pseudocode and E_{RS} is the node's residual energy. The next step is followed by setup phase. The setup phase uses control packets in picking up cluster head.

3.2 SETUP PHASE

It is instigated with the cluster head selection. The steps integrated in the picking of cluster head are illustrated below.

- Initially, source node launches its control packet to the entire member nodes of the cluster group. The control packet encloses the source node's identification number, destination node identification number, location information and the initial energy level.
- Then member nodes will compare their own energy value in control packet with the received value as of the source node and reply if its own value is greater than source node's value.
- Once the source node receives response from the member nodes, it sorts out the energy values according to the higher ranking order and sorts out the node that have the highest energy value.
- Lastly, the node that encompasses the uppermost energy value is designated as its cluster head.

The cluster head exploits the nodes' information about locations and energy levels to establish the weight matrix of the network. Then, it uses Dijkstra steps to estimate the optimal data route for every node. Once the routes for the complete nodes are stated, head proclaim the results to the related nodes. Each node constructs its router table and updates it with its subsequent hop node. For further upcoming rounds, the router table for far nodes is updated. Nevertheless, the close nodes will utilize direct transmission for remaining network operation; henceforth, their routing table would not need an update. This, certainly, minimizes setup cost for the close nodes.

3.3 STEADY STATE PHASE

This stands as the last stage where the levels of energy of every nodes are adhered to the data packet. Then, they commence to transmit their data packet to the subsequent hop nodes. The in-between nodes relay these packets till they attain the destination. As the terminal node obtains these packets from all nodes, it extracts the energy information before updating the weight matrix. The instant this stage is finished, another setup phase begins and so on.

After the part of data transmission in a round is complete, each cluster head chooses whether it will continue to proceed as the head in the next round or another head must be selected. This choice is grounded on final resting energy level of the cluster head. If its rest of energy level is above the source node's energy value, it keeps on its duty as a head intended for the following round. If a cluster head's resting energy level goes below the source node's energy value, a new head needs to be chosen for the following round. The acting cluster head chooses a new one from the members belonging to its cluster. The pseudocode for Steady State Phase is exhibited in Figure 2.

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```
Start
  While ( Q ≠ [] )
        a =min ( Q, Cost )
        Remove a from Q
        if ( a == D )
              Break
          End if
        For all v ∈ Q and nearby u
            If ( a_Cost + Cost(a,v) < v_Cost )
                  v_Cost = a_Cost + Cost(a,v)
                  v_previous = a
            End if
        End for
  End While
End
```

Figure 2: Pseudocode for Steady State Phase

The flowchart of technique proposed is exhibited in Figure 3.

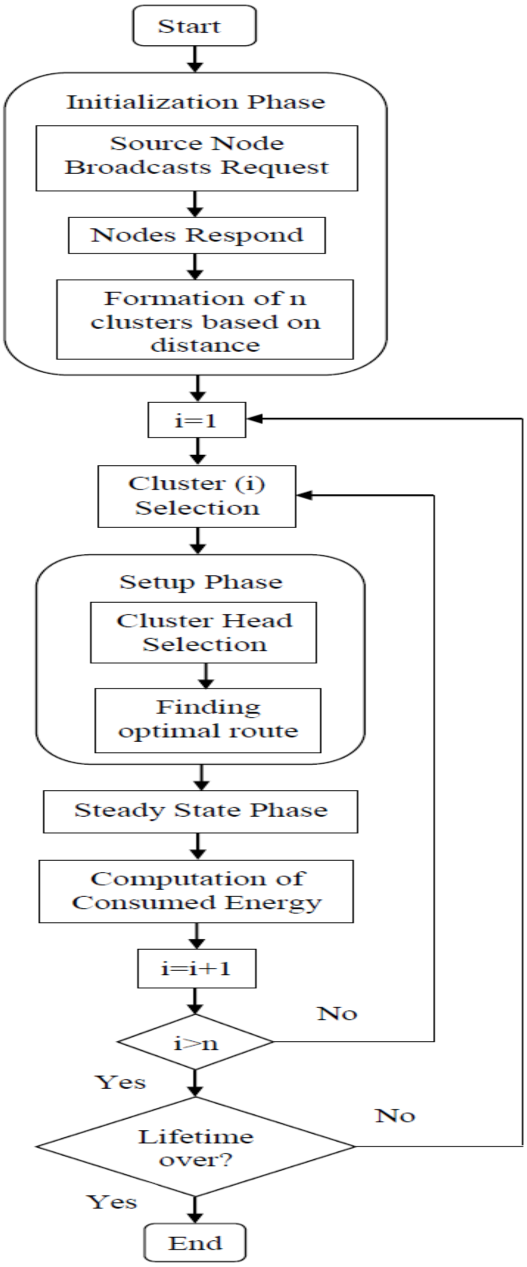

Figure 3: Flowchart of the Proposed Technique

The flow chart is a type of diagram that represents an algorithm, workflow or process. The flow chart shows the steps as boxes of various kinds, and their order by connecting the boxes with arrows. The diagrammatic representation illustrates a solution model to a given problem. They are used in analyzing, designing, documenting or managing a process or program in various fields.

3.4ANALYSIS OF ENERGY CONSUMPTION

The cost intended for the energy utilization of each node in every phase of the work proposed is illustrated below.

3.4.1 INITIALIZATION PHASE

This stands as the initial step where the source node put out the discovery request. The measure of energy devoured by each node to receive in addition responds this request is provided in equation (3).

$$E_{initial} = k_{CP}E_{DE} + k_{CP}E_{DE} + k_{CP}\varepsilon_{amp}d^{n}_{toBS} \qquad (3)$$

Where, $k_{CP}E_{DE}$ is the receive request, $k_{CP}E_{DE} + k_{CP}\varepsilon_{amp}d^{n}_{toBS}$ is the transmit ID, position, level of energy to BS, E_{DE} is the dissipated energy, k_{CP} is the overhead control packet's length and ε_{amp} is the amplification cost factor.

3.4.2 SETUP PHASE

To assess the optimal paths for nodes on the setup phase, a big effort is exerted by BS. As BS is presumed to have a limitless power source, the whole attention is presented to the nodes' energy cost. In this phase, the exhausted energy by each node is restricted to receive the control packet from BS to update its router table as given in equation (4).

$$E_{SetUp} = k_{CP}E_{DE} \qquad (4)$$

Where, $k_{CP}E_{DE}$ is receiving next hop from the previous node.

3.4.3 STEADY STATE PHASE

The energy usage by nodes on this phase is directed by the equations (5), (6) and (7).

The used up energy by the source's transmitter is specified in equation (5).

$$E_{TXM}(k,d) = E_{TXM} - E_{DE}(k) + E_{TXM} - \varepsilon_{amp}(k,d) \quad (5)$$

Where, $E_{TXM} - E_{DE}(k)$ is the component cost and also $E_{TXM} - \varepsilon_{amp}(k,d)$ is the amplification cost.

If the RX tries to aggregate or else combine the data that was received, additional aggregation cost is needed as given in equation (6).

$$E_{RXR}(k) = k.E_{DE} + k.E_{DA} \qquad (6)$$

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Where, $k.E_{DE}$ is the Component cost and $k.E_{DA}$ stands as the Aggregation cost.

If a given node works as in-between node to relay data between a source and a destination, next the energy utilization is provided by (7).

$$E_R(k,d) = E_{RXR}(k) + E_{TXM}(k,d) \tag{7}$$

IV. RESULT AND DISCUSSION

The proposed EECMR performance is contrasted with the existing strategies say Dynamic Source Routing (DSR) protocol, Energy Conscious Dynamic Routing Protocol (ECDSR) and AODV (Ad hoc On-Demand Distance Vector) protocol. The outcomes were compared and evaluated against these existing protocols concerning residual energy, throughput, energy consumption and also all over end-to-end delay.

The system proposed is actualized on Matlab Simulink. It is a simulation in addition model grounded design environment aimed at dynamic and also embedded frameworks. It stands as a data flow graphical programming language instrument aimed at modeling, simulating in addition examining multi-domain dynamic system. It is capable of systematic confirmation and approval of models through modeling style checking, prerequisites traceability and model coverage analysis.

4.1 RESIDUAL ENERGY

Residual Energy is the prevailing rest of energy in the node. Figure 4 contrasts this concern for a specific amount of nodes on the network.

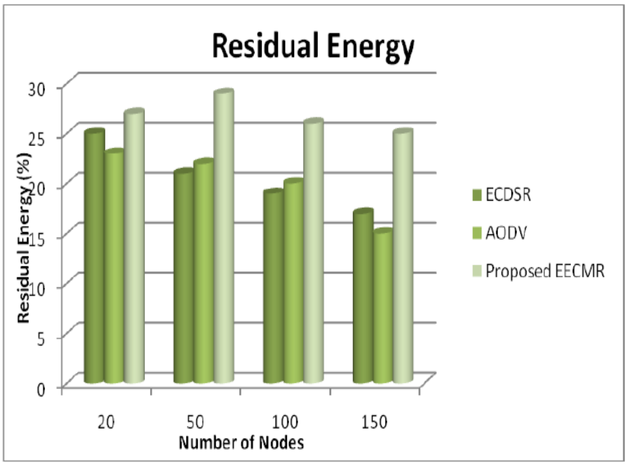

Figure 4: Comparison of Residual Energy

Figure 4 compares the residual energy of the existing Energy Conscious Dynamic Routing Protocol (ECDSR), AODV Protocol and the proposed EECMR technique. The proposed EECMR demonstrates greater performance for the compared number of nodes is perceived as of the figure 4 that. In the existing strategies, it diminishes as the measure of nodes increments. For the 150 amount of nodes, the existing systems demonstrate poor performance, yet the proposed strategy has 25% of this residual energy.

4.2 THROUGHPUT

Throughput is stated as the data transported over some stretch of time communicated in kbps or the proportion of data packets directed to the gotten data packets. It is additionally characterized as the rate of effective message transmission via a communication channel. The adequacy of a routing protocol is assessed through the throughput estimation which is the total of packets got by the recipient within certain time interim.

The nature of Wi Fi technology makes throughput hard to predict. Therefore, network administrator's makes reasonable expectations for connection speeds, number of nodes in mind. Interference and distance from client device to the access point are the two major factors that have a negative impact on observed maximum throughput. The access point of client speed test tool is especially useful in distinguishing bandwidth constraints on network and bandwidth constraints on internet connection.

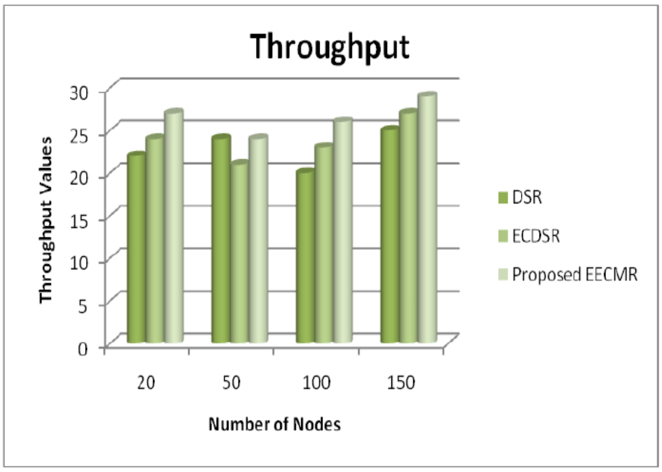

Figure 5: Comparison of Throughput

Figure 5 demonstrates the throughput values against the nodes on the network. The contrast is made betwixt the existing DSR, ECDSR and the proposed EECMR. On considering 50 nodes, the existing DSR and the proposed EECMR shows equal throughput values, but for the other amount of nodes like 20, 100 and 150, the proposed technique shows the high throughput values.

4.3 ENERGY CONSUMPTION

On a network, this varies significantly based upon the routing protocol utilized for the communication. It is the energy devoured by network for every packet gotten via the destination. It is plotted against various numbers of nodes. The graph is plotted for 20-150 nodes as appeared in Figure 6.

As we move to LTE, we can expect an increase in energy consumption because LTE radios are less efficient than 3G radios due to the OFDM physical layer and requires more radios for MIMO. Radios account for anywhere between 40-80% of the base station total power consumption. For this reason there has been a fair bit of work on improving the efficiency of power amplifiers. There are other

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techniques also used to reduce overall power consumption like the adoption of remote radios. So while demand on energy increases, there are new techniques being introduced to keep energy consumption in check.

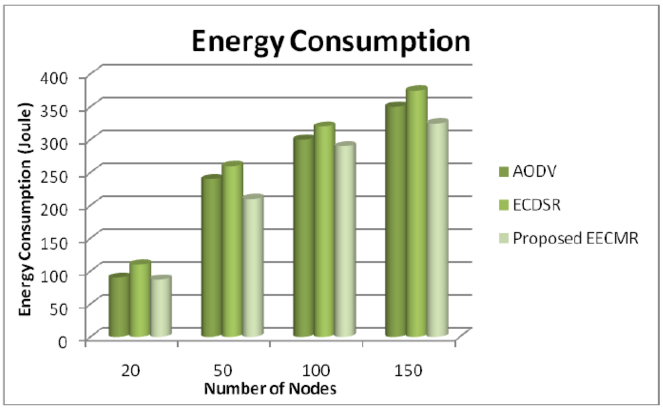

Figure 6: Comparison of Energy Consumption

Figure 6 illustrates the contrast of prevailing AODV, ECDSR techniques and the proposed EECMR technique grounded on their energy usage. It is noticed that the energy use is increasing for both the existing and the proposed techniques as the number of node augments. Regarding all the compared nodes, the works proposed shows the smaller energy consumption when contrasted with the existing ones.

4.4 END-TO-END DELAY

It signifies the aggregate time used by the file to reach as of source to terminal node furthermore comprises of all the various delays experienced by the packets during their passage as of transmitter to receiver. The processing delay depends on router processing capability along with router load. It as well includes the retransmission delay betwixt intermediary nodes. For average of this concern, each delay is added for successively packet and is divided by the number of successively received packet. A lower value of this in a routing protocol represents proficient routing protocol, quick routes convergence and packets traversing the finest routes.

End-to-end delay or one-way delay (OWD) refers to the time taken for a packet to be transmitted across a network from source to destination. It is a common term in IP network monitoring, and differs from round-trip time (RTT) in that only path in the one direction from source to destination is measured. The problem of scheduling transmission in single hop and multi-hop wireless networks with arbitrary topology under the physical interference model has been extensively studied. The focus has been on optimizing the efficiency of transmission parallelization through a minimum-frame-length schedule that meets a given set of traffic demands using the smallest number of time slots.

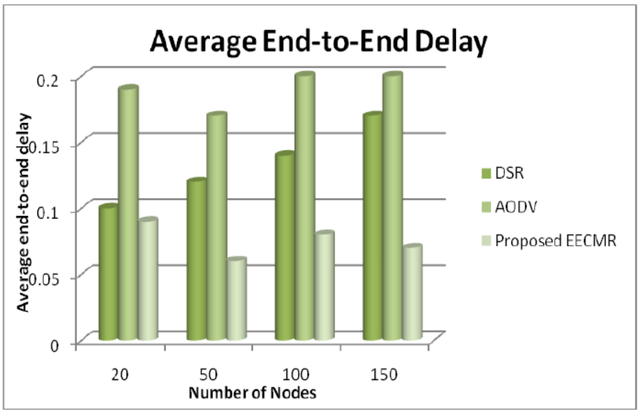

Figure 7: Comparison of Average End-to-End Delay

Figure 7 contrasts the prevailing DSR, AODV techniques and the proposed EECMR technique grounded on the concern of average end-end delay, which is higher for the existing technique AODV considering all the compared nodes, which implies a poor performance. On considering the existing DSR technique, it increases as all the nodes augments. Also, the all over delay is too low for 50 nodes than the other ones. Hence, this for the proposed EECMR is lower for all the compared nodes, which infers a good performance.

V. CONCLUSION

Energy efficient and cluster based multi-hop routing of nodes on LTE network is proposed in the given paper, in which the energy of the nodes on the LTE network is proficiently utilized with the support of cluster centered approach. This method gives incredible enthusiasm to the residual energy of nodes; thus higher energy nodes are solely chosen to fill in as relays. The proposed EECMR performance is contrasted with the existing techniques like DSR protocol, ECDSR and AODV protocol. The outcomes were compared and evaluated against these existing protocols regarding residual energy, throughput, energy consumption along with end-end delay. Regarding all these performance metrics, the EECMR which is proposed demonstrates the better performance when compared than the current ones. Simulation results demonstrate that the proposed strategy outflanks the other customary techniques, for example, DSR, ECDSR and AODV.

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