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Effect of limiting the hop count: Distributed Three-Hop Routing Protocol

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Abstract--- *Hybrid Wireless Networks have gained a lot of importance because of its ultra-high performance in today's networking world. Hybrid Wireless Networks consists of both Mobile Ad-hoc Network (MANET) and Infrastructure Wireless Networks. MANETs are infrastructreless and most probably short lived networks where mobile nodes communicate directly through peer-to-peer. Infrastructure Wireless Network requires a central point of access. As there are advantages of using these two together there are also disadvantages that leads to high overload, increase in number of hotspots, low reliability. Thus, we need routing protocols to increase the network scalability and capacity. However, these flaws will be overcome using Distributed Three-Hop Routing Protocol leading to low overhead, reduced number of hotspots and increase in reliability. A distributed Three-Hop Routing protocol (DTR) divides a message stream into number of segments and then transmit these segments in a distributed manner. It makes full use of widespread base stations using its high speed ad-hoc interface and reduces congestion using its cellular interface. DTR reduces the overhead by eliminating the work for route discovery and maintenance. Finally we can improve the lifetime of the network by analyzing the impact of limiting the hop count. This is done by calculating the energy efficiency of every node.*

Keywords---*MANET, DTR , Protocols, Routing.*

I. INTRODUCTION

Hybrid Wireless Networks have gained a lot of importance due to the ultra high performance. Hybrid Wireless Networks consists of both Mobile Ad-hoc Network (MANET) and Infrastructure Wireless Networks. MANETs are infrastructreless and most probably over quickly networks where mobile nodes communicate directly through peer-to-peer. Infrastructure Wireless Network takes a central point of access. As there are features of using these two together additionally, there is a disadvantage which leads to high overload on account of route discovery and maintenance, increase in variety of hotspots as mobile gateway nodes could be hotspots, low reliability as a result of long and dynamic routing paths. Thus, we require routing protocols to increase the network scalability and capacity. However, these flaws is going to be overcome using Distributed Three-Hop Routing Protocol (DTR) leading to low overhead, reduced quantity of hotspots while increasing in reliability.

Distributed Three-Hop Routing protocol divides a message stream into nmber of segments then transmits these segments in a distributed manner. It makes better use of widespread base stations having its very fast ad-hoc interface and reduces congestion having its cellular interface. DTR reduces the overhead by reducing the task for route discovery and maintenance. It also avoids the overloading of the base stations.

II. LITERATURE SURVEY

2.1 Paper Name: Cooperative Packet Delivery in Hybrid Wireless Mobile Networks: A Coalitional Game Approach [2]

Authors: Khajonpong Akkarajitsakul, Ekram Hossain, Dusit Niyato

Description: Here creators consider the matters of helpful bundle conveyance to versatile hubs amid a mixture remote portable system, where both foundations based and framework less (i.e., spontaneous mode or shared mode) interchanges are utilized. We have a tendency to propose an answer bolstered a coalition arrangement among portable hubs to turn in glove convey parcels among these versatile hubs inside a similar coalition. A coalitional amusement is created to examine the conduct of the levelheaded portable hubs for agreeable bundle conveyance. A gathering of portable hubs makes a call to append or to leave a coalition bolstered their individual adjustments. The individual result of each versatile hub might be a perform of the run of the mill conveyance delay for parcels transmitted to the portable hub from

a base station and furthermore the esteem caused by this versatile hub for handing-off bundles to various portable hubs. to look out the result of each versatile hub, a Markoff procedure show is detailed and furthermore the normal esteem and parcel conveyance delay are gotten once the portable hub is amid a coalition. Since each the normal esteem and parcel conveyance delay rely on the probability that each portable hub can encourage diverse versatile hubs inside a similar coalition to forward bundles to the goal portable hub inside a similar coalition, a discussions amusement is utilized to look out the ideal serving to probabilities. At the point when the result of each portable hub is acquired, we find the arrangements of the coalitional amusement that are the steady coalitions. A conveyed algorithmic govern is gave to get the steady coalitions and a Markov-chain-based investigation is utilized to judge the stable coalitional structures acquired from the disseminated algorithmic run the show. Execution examination comes about demonstrate that once the steady coalitions are molded, the versatile hubs come to a nonzero result (i.e., utility is past the cost). With a coalition arrangement, the portable hubs achieve higher result than that once every versatile hub acts alone.

2.2 Paper Name: A Distributed Three-hop Routing Protocol to Increase the Capacity of Hybrid Networks [1]
Authors: Ze Li and Haiying Shen
Description: Hybrid wireless networks combining the benefits of each ad-hoc networks and infrastructure wireless networks are receiving more and more attentions as a result of their ultra-high performance. An economical information routing protocol is a vital element in such networks for top capacity and quantity. However, most routing protocols for the networks merely mix ad-hoc transmission mode and a cellular transmission mode, which fail to require advantage of the dual-feature design. This paper presents a distributed Three-hop Routing (DTR) protocol for hybrid wireless networks. DTR divides a message information stream into segments and transmits the segments in a very distributed manner. It makes full spatial recycle of system via high speed ad-hoc interface and mobile entry congestion via cellular interface.

2.3 Paper Name: Capacity of a Wireless Ad Hoc Network with Infrastructure [4]
Authors: Benyuan Liu, Patrick Thiran, Don Towsley
Description: In this paper we tend to examine the ability of remote surprising systems with foundation support of partner overlay of wired base stations. Such a determination is normally alluded to as cross breed remote system or multi-hop cell organize. Past examinations regarding this matter are altogether fixated on the two dimensional circle display arranged by Gupta and Kumar in their unique work on the ability of remote surprising systems. We extra consider a one-dimensional system demonstrates and a two-dimensional strip model to explore the effect of system spatiality and immaculate science on the capacity of such systems. Our outcomes demonstrate that totally extraordinary system measurements prompt extensively totally extraordinary capacity scaling laws.

2.4 Paper Name: Interference aware resource allocation for hybrid hierarchical wireless networks [5]
Authors: Preetha Thulasiraman, Xuemin (Sherman) Shen
Description: This paper tends to the matter of impedance mindful asset designation for OFDMA based half breed class-cognizant remote systems. Creators tend to create two asset designation calculations considering the effect of remote impedance requirements utilizing a weighted SINR struggle chart to measure the obstruction among the varying hubs:
(1) Impedance mindful steering misuse most synchronal stream streamlining; and
(2) Rate adaptation joint subcarrier and power assignment equation underneath impedance and QoS imperatives. We misuse spatial reprocess to dispense subcarriers inside the system demonstrate that a wise reprocess of assets will enhance yield though alleviating impedance. Creators offer an imperfect heuristic to determine the speed adaptation asset allotment downside. We tend to show that forceful unique reprocess and tweaked obstruction displaying gather benefits as far as yield, end-to-end postpone and control circulation.

2.5 Paper Name: A node-based available bandwidth evaluation in IEEE 802.11 ad hoc networks [6]
Authors: Cheikh Sarr, Claude Chaudet, Guillaume Chelius, Isabelle Guerin Lassous
Description: In this article authors proposes a substitute way to estimate the information measure on the market to wireless nodes and by extension on one-hop links in IEEE 802.11-based circumstantial networks. The technique exploits the very fact that the node will estimate the channel guests by observation its environment. It provides a non-intrusive estimation which means that it doesn't generate any further traffic to perform the analysis. Authors have a tendency to show by simulations that our technique provides associate appropriate estimation of the industry information measure on wireless links in several circumstantial configurations. However, we have a tendency to surprise conjointly a setting

during which this method doesn't offer correct quotes and propose a customization of our expert boosting its preciseness in this case.

III.METHDOLOGY

3.1 Methodology:

1. Distributed Three-Hop Routing Protocol:

DTR uses at most two hops to transmit the segments to the BSes in a distributed manner, and depends on the BSes to combine the segments. Using the advantages of the infrastructure wireless network, when a source wants to send the message to the destination, DTR divides the message into number of partial segments and transmits each segment to the neighbor nodes. Neighbor nodes then decide locally between direct transmission and relay transmission based on the QoS requirement of the application. The neighbor nodes then transmit these segments to the BSes in a distributed manner. The BS further transmits these segments to the final BS where the destination node resides. The data routing process in DTR can be divided into two steps: uplink from source node to the first BS and downlink from the final BS to the destination node.

2. Uplink Data Routing:

When choosing the neighbor nodes the source node must know the capacity information about the neighbor nodes i.e., queue size and bandwidth. To keep track of the capacity and the storage space of its neighbors, each node periodically exchanges this information with each other. In ad-hoc network, every node periodically sends hello messages to reveal its identity. Taking advantage of this strategy, the nodes exchange the capacity information with each other. To find the high capacity node in the neighborhood, each segment receiver or the neighbor node locally decides between the direct transmission and relay transmission.

3. Downlink and Data Reconstruction:

Each BS periodically sends beacon signals to locate the mobile nodes in its region. Cellular IP is used to locating the mobile nodes. With this concept, a BS has a home agent and a foreign agent. The foreign agent keeps track of mobile nodes moving into the ranges of other BSes. The home agent intercepts the incoming segments, reconstructs the original data, and re-routes it to the foreign agent, which then forwards the data to the destination mobile node.

DTR provides a segment structure format for the final BS to rearrange the segments in original order. Each segment contains eight fields, including:-

1. Source node IP address- denoted by S
2. Destination IP address-denoted by D
3. Message sequence number- denoted by m
4. Segment sequence number -denoted by S
5. QoS indication number-denoted by q
6. Data
7. Length of the data and
8. Checksum.

Fields 1-5 are in segment head.

4. Congestion Control in BSes:

BSes send beacon signals to identify the nearby nodes. Taking advantage of this beacon strategy, once the workload of a BS exceeds a pre-defined threshold, it adds an extra bit in its beacon message to broadcast to all the nodes in its transmission range indicating that it has been overloaded. Thus the nodes than find the lightly neighbor nodes in the transmission range of the overloaded BS to transmit the segment.

IV. SYSTEM ARCHITECTURE

DTR divides message stream into amount of segments after which sends these segments along to other mobile nodes or the BSes in a distributed manner. DTR works on Internet layer. It receives the packets through the TCP layer and routes it to the destination node TCP layer. Data routing process is split into two steps: uplink from the source node on the first BS and downlink from the final BS on the destination node. DTR limits the path length to avoid high overhead, hotspots

and low reliability. It uses one hop to forward the segments of a message in distributed manner and the other hop to discover the high capacity forwarder.

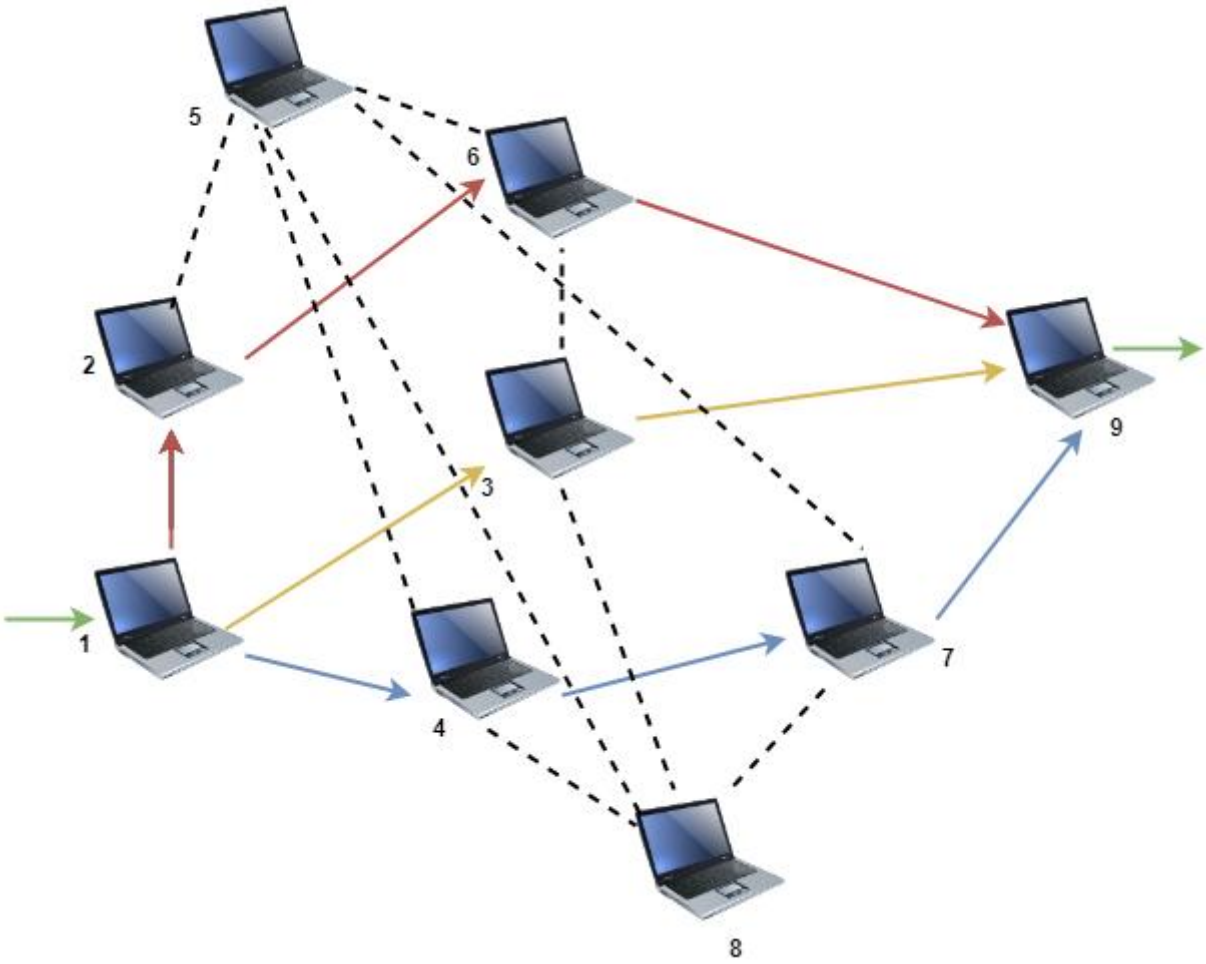


Fig 1: System Architecture Showing 3 Way Routing

4.1 Advantages of Proposed System:

1. Increasing reliability by eliminating long routing paths.
2. Increasing network scalability, capacity and lifetime.
3. Avoiding congestion in overloading BSes.
4. Reducing overhead by eliminating on demand route discovery and maintenance.

V. MATHEMATICAL MODEL

The proposed system used below mathematical approach.
Now here S is the system which including the
S = {I, O, R}
I = {N1, N2, N3}
Where,
N1 = {N11, N12} is number of nodes.
N2 = {SN} is source node.
N3 = {DN} is destination node.

O = is set of outputs where 3 hops will be displayed.

R = is a function where the data is routed from source to destination.

The message will be divided into streams and the it will be forwarded in distributed manner.

Where system will be define as,
Let W= {NN, SN, D, BS}

Where,

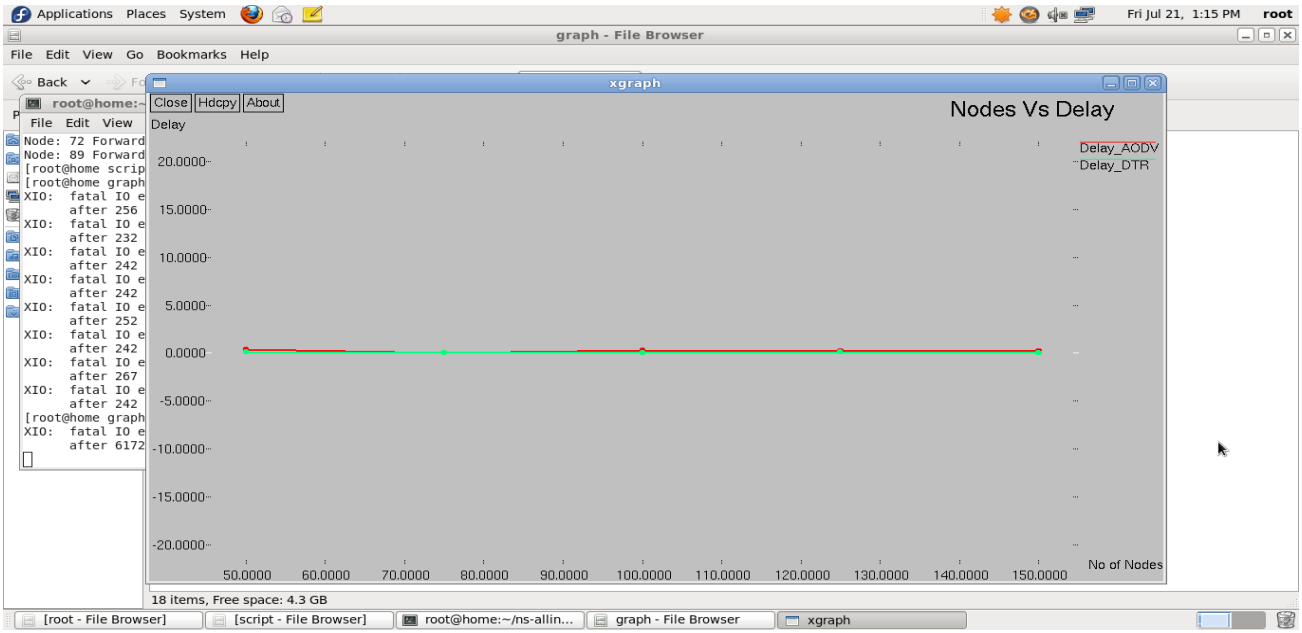
1. NN= Neighbor nodes.
   Choose Neighbor nodes.
2. **SN=** source node.
   If it is a source node then,
   - Routing conducted by a source node.
   - Choose relay nodes based on requirement.
3. Send segments through source node.
4. Routing conducted by a neighbor node.
5. Selection of neighbor node and message forwarding.
6. Divide or segmentation over 3 hop path.
7. BS= Base Station
   Congestion control in Base station
8. Check next hop is BS or not?
   Where D = Destination
   - If it is a Base station the it directly act as a destination and;
   - If it is not a Base station then again send data to next 3 hops and it will reaches to destination.

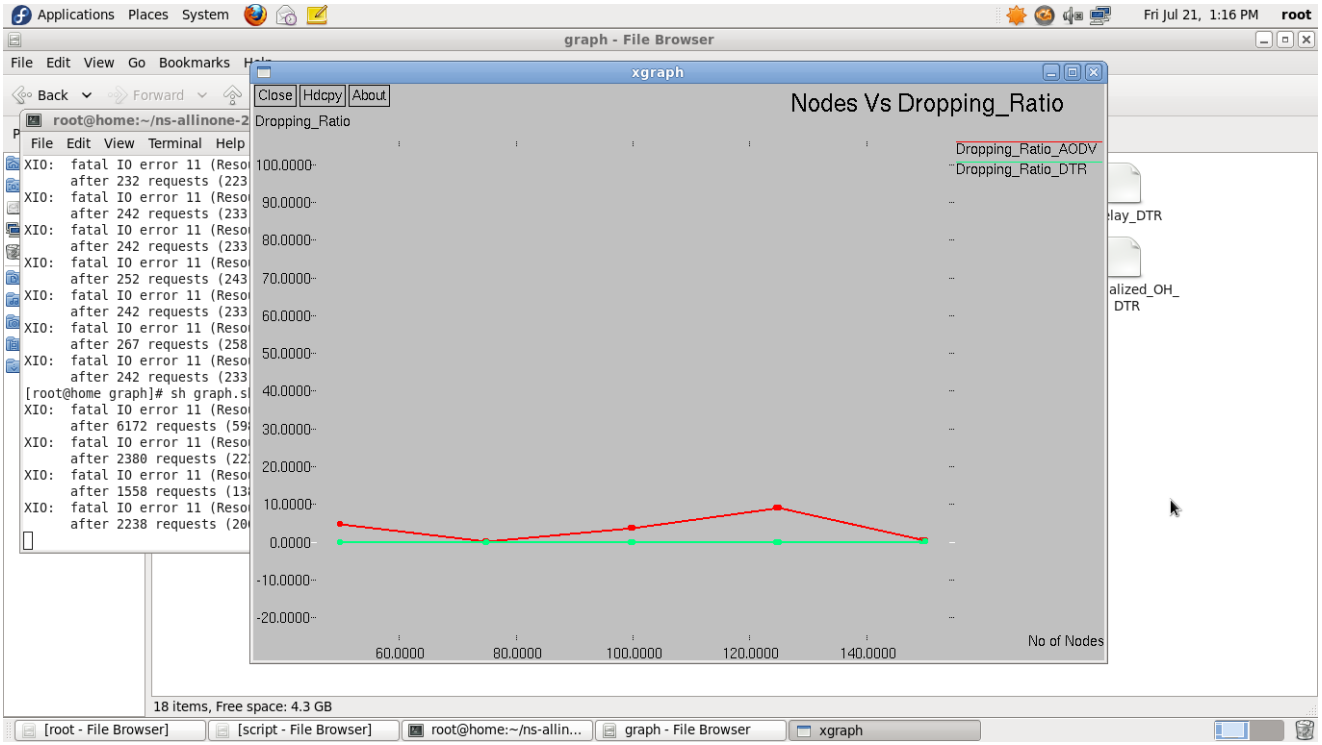
VI. RESULT

TRANSMISSION DELAY AND DROPPING RATE

Following Fig shows the avg communication delay between the source and destination in two different routing protocols. As the number of nodes increases usually the delay increases in Dhybrid. As in our network there is no communication delay between the source and destination nodes as we are limiting the number of hops from source and destination.. In AODV, as the number of BSes increases, it leads to fewer communication hops and better transmission links between nodes and BSes. Thus, the transmission delay between the nodes is reduced. Since the communication between S-D pairs in AODV does not rely on BSes, AODV maintains constant communication delay.

As in hybrid Wireless Network mobile gateway nodes are easy to become hotspots. Thus hotspots leads to low transmission rates, severe network congestion and high data dropping rates. Thus by eliminating the extra work of route discovery and maintenance, we can increase the reliability of our network.





VII. CONCLUSION AND FUTURE SCOPE

DTR reduces overhead by reducing route discovery and maintenance. Additional characteristics for example node selection, finding high capacity forwarder, short path lengths, congestion avoidance are proposed by DTR. DTR significantly adds to the network throughput capacity because of its top quality, scalability, and reliability for the Hybrid Wireless Networks. DTR increases throughput capacity of the network. It eliminates long routing paths. It eliminates the efforts for route discovery and maintenance. Italso has congestion control algorithm to avoid overloading in the BSes during the message passing within the network.

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