# Performance of Algorithms using Domination Theory in Wireless Sensor Network with NS2

**Venugeetha Y, Mallikarjunaswamy**

***Abstract: To prologue about a wireless sensor network let us understand network originally; how to connect host computers as well as communicate. Computers that are connected together are represented as topology, there are different types to name them star, bus, mesh, and grid. Researchers represented it as TCP i.e., transmission control protocol that has to be a wired connection through the network. As researcher worked, even without wired connection to the host computers could even be communicated through UDP called user datagram protocol. UDP gave nativity to the wireless sensor network, it has its own pros and cons. Now a day, there are a number of types of wireless sensor network like adhoc network, under water sensor network and vehicular sensor network. An organized design of routing protocol is available in wireless sensor network, and then Connected Dominating Set (CDS) is broadly used as a essential part as a backbone. To construct the Connected Dominating Set with its size as minimum, meta-heuristic, greedy, approximation, heuristic and distributed algorithmic approaches are predictable. These approaches are concentrated on deriving independent set and then constructing the Connected Dominating Set using Steiner tree, Unit Disk Graph and algorithms gives better result when graph has lesser number of nodes. For the networks that are generated in a fixed simulation area. A new approach is used for building Connected Dominating Set based on the concept of Edge Dominating Set.***

***Keywords : WSN, EDS, CEDS .***

## I. INTRODUCTION

A Wireless Sensor Network is a group of outsized number of nodes along with a minimum of one base station [13][14]. The node is an independent tiny device that consists of four units such as sensing, processing, communication and power supply. These are used to collect the information from the environment and submit the collected data to the base station [3][4]. A base station is intern connected to the server say the data collected is analyzed, processed and represented to functional applications. Therefore by embedding processing and communication within the physical world, Wireless Sensor Network can be used to bridge virtual and real environment. A standardized Wireless Sensor Network consists of devices called sensor that are of same kind [5].

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Every sensor device has identical limited resources; originally, no hierarchy is forced on structure of the network and communications. In a wireless network, base station is considered to be a sensor node [18].

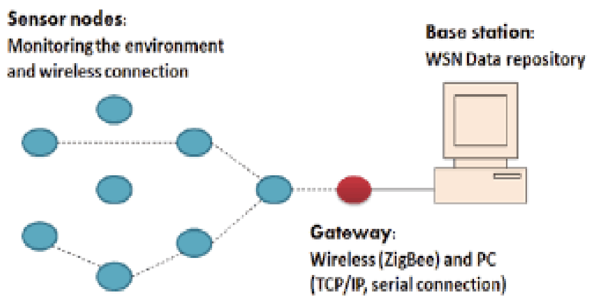



**Fig.1: WSN composed of Sensor Nodes, a Base Station and a Remote Server.**

- **Sensor node**, is a tiny device that can sense the environment wherever deployed and pass the information towards the base station. Sensors measure for what they are deployed in the physical environment. Parameters considered for assessment using a sensor nodes are temperature, pressure, and sound along with humidity.
- **Base station**, Base station is also a node in a network with additional functionality like repository of data that was collected in communication with all sensor nodes along with data as well information [13]. This node has internally radio board for signal transmission to communicate, antenna to receive signals also a microprocessor with a USB board in it. A low power mesh networking software is been programmed in a base station. For the gathering about data as of all nodes has to be stored at one point in the cluster, that is done by the base station and it has to be deployed as it is one of the important nodes among the network.
- **Gateway,** A gateway is represented as an application platform along with nodes in a WSN. When a sensor node in a network transmits data or information in the form of a packet it is aggregated by the gateway along with forwarding the application. This application is expected to execute on a local system or a distributed system. Similarly, when a command is concerned by the application platform to sensor node in the network, gateway helps to relay the information of the same. In a wireless network to work with non-standard protocols of network gateways help to perform protocol conversion that enable wireless network [17][5].
- **Relay Node,** Routers are generally represented as relay node with the consideration that it is full-function device.

They are the devices which connect between networks and also can be used for extending the network area. Router provides backup routes and also route around barriers like congestion in network or failure of nodes say devices [18]. Relay node provide similar functionality of a leaf node i.e., connecting via analog also digital interface to sensor and actuator.

- **Leaf Node**,

A leaf node in the network is like a connection to the remaining part of the network, also considered as reduced function device. This device is called the endpoint or the leaf node. It helps in providing interface involving wireless sensor network along with sensor or actuator which are connected to each other. Leaf node can connect and communicate with the sensors and with the actuator devices [19].

- **Sensor/Actuator**,

Sensor and actuator are devices used for interaction with the environment or with the physical system which has to be monitored or controlled. Sensor monitors the temperature in a room and actuator controls the air-conditioned equipment [17].

**Sensor Network Objectives**

Reliability, accuracy, flexibility, cost effectiveness and also ease of deployment are some of basic as well as the fundamental objectives of a Wireless Sensor Networks.

## II. CHARACTERISTICS OF WIRELESS SENSOR NETWORK

### A. Topologies for Wireless Sensor Network

While designing the network the designer has lot of choice for structuring the topologies in a WSN. There are a number of topologies to name them among single-hop as well multi-hop message transmissions are presented in Fig.2.

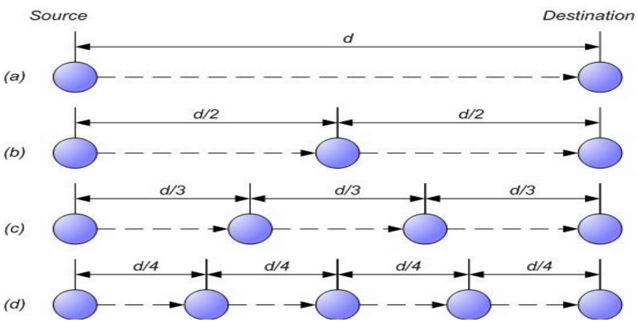



**Fig.2. Transmission range distances (i) Single Hop (ii) Double Hop (iii) Triple Hop (iv) Quad Hop**

Several destinations might be achieved through any huge groups from smaller hops or say multi-hops otherwise small groups from larger hops (single-hop).

- Single-Hop Star Topology:

When there is a small network called single-hop star topology. The star topology used here is a simple wireless sensor network topology. When a node sends data, next node itself is a gateway; it is a single-hop topology. Suppose the distance is large from gateway to the node, then connectivity to that node is of poor quality. Hence the coverage area of the node should be within the interference range or transmission range that helps the node with good connectivity.

- Multi-Hop Mesh and Grid Topology:

When a large area network is covered, then the signal moves from one node to other until it reaches the gateway, multi-hop
is necessary when the network has millions of nodes. Depending on whether the network is structured or else random, a routing protocol establishes route for the signal to

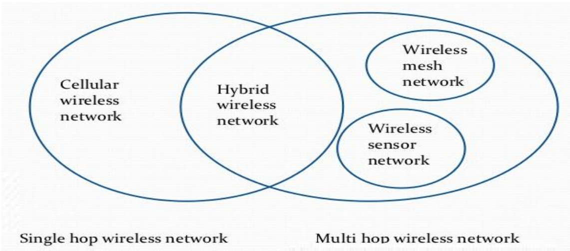



**Fig.3. Single hop and Multi hop wireless network.**

reach destination from source node [1][8]. It takes more or multiple hop to reach the gateway to transfer the data.

- Two-Tier Hierarchical Cluster Topology:

When a larger wireless sensor network has to be raised then a common architecture used is a Two-Tier hierarchical cluster. The network is made of regions along with local cluster head that helps to send data through the cluster head. Similar concept is applied for the number of regions framed. As the region has nodes they need even cluster head and a gateway to connect to different regions in the large network. One of the advantages of making cluster is that large network is divided into small zones in which routing of signals is taken care within the limited cluster.

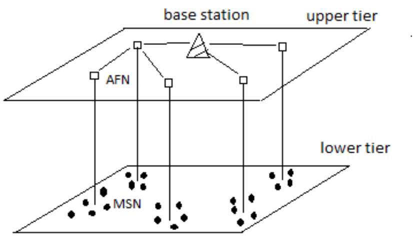



**Fig.4. Two-tier Hierarchical Structure**

### B. Parameters to Measure Topology Effectiveness

- Range and coverage:

One of the parameter to check the topology effectiveness in wireless network is called range. This helps the node to communicate effectively if communicating nodes are within the same interference range as well as the antenna, data rate is same it can be called as coverage. A requirement for the coverage helps to eradicate dead spots of the network within the coverage area.

- Hop Count:

Number of nodes it takes to pass through to reach the destination from the source is hop count. As it is one of the parameter, wireless network should be so connected that nodes when broadcast message to the final node, the packet should reach the destination with minimum number of crossing of nodes.

 Power consumption / Network Longevity:

Nodes in a network should be positioned at a distance so as to arrive from source to target end. If number of hop count increases that leads to draining of energy in a node, even a node will lose complete energy without delivery of packet to destination.

Hence power consumption has been important in network as lifetime of network depends on energy of node [17].

### C. Challenges for Wireless Sensor Network

 Power management: It is important for long term operation, especially when it is needed to monitoring isolated and unfriendly environments. To enhance the sensors lifetime; one of the solution are Cross-layer protocols, harvesting schemes and new device to store power.

 Remote management: Systems installed on remote area cannot be visited repeatedly, so are mote access standard protocol that is essential to reprogramming, operate, administer, and organize Wireless Sensor Network.

 Usability: Wireless Sensor Network is deployed by users who buy and it becomes easier to understand, install and maintain. It is essential to intend new plug and play mechanisms and develop software modules with more user-friendly interface.

 Standardization: IEEE 802.15.4 represents milestone in standardization. It is important to specify standard interfaces to allow inter operability between various module purveyors in order to reduce the cost and to enhance the existing choice.

### D. Algorithm Prototype for Wireless Sensor Network

WSN has number of algorithms along with these algorithm functions they are grouped accordingly. Intention of these sensor applications demands communication among the nodes to execute the procedures for interaction [4].

They can be represented as centralized, distributed with local based algorithm.

 Centralized Algorithms:

Centralized algorithms are quite exceptional as for the reason that cost of broadcasting the data to inform every node about itself is to have the status of the network. Hence nodes considered in this network should have complete information of the same which makes it expensive. Messages are generated by n number of source nodes, all put together they are stored in the central node [8].

 Distributed Algorithms:

Distributed algorithm resourcefully support message-passing described as communication between sensor nodes pairs. Hence the neighboring nodes will inform its details as well changes to their neighbor nodes to create path to the destination. If any neighboring node fails, otherwise it is in inactive mode due to any design constraint reason [5].

 Local based Algorithms:

Local based algorithm also takes care of information of nodes as well its details. Here the nodes share only restricted data that are collected from the neighboring area. Localized algorithms are used then routing protocol support moreover optimize communication between neighbors. Lastly local algorithm is focused on solution that give the area coordinates through GPS, hence making it expensive [17].

## III. LITERATURE REVIEW

M. Yannakakist et. al., [1980], They proved that whether the graph is planar as well as bipartite with a maximum of 3 degree, it can be an NP complete even for problem of edge dominating set. They have also confirmed an NP complete problem can even be achromatic number as well as minimum maximal matching. With respect to domination theory observed concepts are related to edge dominating set with independent set in a total graphs. They have also proposed a novel approach, linear time algorithm that describes edge dominating set in tree [12].

Samir Khullerz et. al.,[1996], They have discussed on network testing on a general problem say travelling salesman. It has given a performance ratio of 3ln n. That resulted to achieve factor of 2 approximation for 2 polynomial time approximability $O(H(\Delta))$, $\Delta$ be max degree as well as H be harmonic function [21].

Guha et. al., [1998], stressed upon 2 polynomial time algorithm with the aim to create a graph G resulting in a connected dominating set. Guha as well as their team have worked on harmonic function for the outcome of an algorithm that has approximation ratio of $2(H(\Delta)+1)$. The polynomial time algorithms have worked on a node degree resulted to maximum at root node for construction of a spanning tree. The second algorithm be more refined from the first one having two phases: In the 1st phase construction of a dominating set. In 2nd phase connecting the dominating set using approximation algorithm for Steiner tree problem giving performance ratio of $H(\Delta)+2$ and both the algorithms are greedy and centralized [21].

Toshihiro Fujito., [2001], Fujito has investigated on graphs with edge dominating set related problems resulting in approximability of polynomial time. Also worked as well could not find the approximated factor surrounded by a polynomial computation for P = NP for a maximal matching. Fujito proved CEDS is able to have a factor of $3 + \varepsilon$, as well as an approximation factor of *ln* n+3 for a vertex cover problem. Resulting factor will not be $(1-\varepsilon)$ *ln* n for an $\varepsilon > 0$ until NP $\subset$ D TIME( $n^{O(\log \log n)}$) [13].

Khaled M et. al., [2002], anticipated as well researched on algorithms designed for three distributed approximation considering minimum CDS. They are algorithms which guarantee the construction of connected dominating set. It's complexity on message is maximum of $O(n^2)$, along with complexity on time be $O(n^3)$. These algorithms have an approximation factor of atmost 8, with O(n log n) message and O(n) time complexities [9].

Ning Chen et. al., [2004], studied on dominating set problem with measure functions like complexity, approximation and inapproximability for dominating problem. [15].

Mathieu Couture et. al., [2006], worked as well researched graph G with K-dominating set. Every graph G be a subset S from its vertex. Hence the vertex will be found either in G or in S along with K neighbors. Researcher proposed a new incremental local algorithm for UDG, resultant evaluates almost six times the optimal [2].

Henning et. al., [2006], analyzed edge dominating set from various perspectives to prove FPT designed for general graphs and other algorithms have been developed with enumeration techniques. In particular, showed how to utilize the condensed illustration can speed up decision algorithm [1].

X. Cheng et. al., [2006], worked on wireless network to create a virtual backbone with concept of CDS. The team has worked using a hierarchical network topology to control different fundamental characteristics of the network like flatness, scalability as well as efficiency [20].

Decheng Dai et al., [2009], studied on weighted UDG as well improvising 6+ε using polynomial time algorithm to 5+ε while solving problem on minimum weighted dominating set. They combined common technique to compute and give better results minimum weight dominating set problem as of 10+ε to approximation ration to better performance result to 9+ε [11].

Jukka Suomela [2010], researched on finding minimum edge dominating set using a deterministic dominating algorithm, that mainly focus on port numbered network. Every node is given a port numbered network, with no unique identifiers. Every nodes have a degree to facilitate refers to the number of neighbors connected by integer representation in a sequence. The port numbering model working is shown as an edge dominating set using d – regular graph with odd as well even with a maximum degree Δ. Resulting in matching lower bound as well ratio for values of d with Δ[8].

Xiafeng Gao et. al., [2012], proposed inherent lack of infrastructure and characteristics of wireless network. Team has worked on ((k,m) - CDS) representing itself as k connected as well as m dominating set. As fault tolerant which helps the routing process to save every of non-dominators and improve the performance of a network. Three algorithms were proposed like DSA, connection algorithm (CA) and Connectivity Expansion Algorithm (CEA). Simulation result improves the performance comparatively has a [14].

Mingyu Xiao et al., [2014], presented a novel approach for edge dominating set problem to yield an exact algorithm as well as to evaluate time complexities resulted $1.3160^n n^{O(1)}$ as long as graph G be with n vertices [7].

Faisal N. Abu-Khzamet. al., [2015], recommended a novel approach with a better outcome of O(Diam) as its time analysis for dominating algorithm with a constant approximation factor Diam is the graph diameter represented. With simulation study, this approach has outperformed other algorithm [3].

## IV. ALGORITHMIC APPROACHES FOR CONNECTED DOMINATING SET IN WSN

A Connected Dominating Set is usual need for virtual backbone infrastructure in a network. A Connected Dominating Set is that any node in wireless network is a part of group, otherwise is a part of the neighbor in the connected dominating set which is called as connected subset of the network. The CDS should be generally small in size as well conserve the shortest path in the wireless network, to form a virtual backbone. CDS should be assessable by means of fast distributed local control algorithms. Connected Dominating Set algorithms can be classified into three categories.

In a complete network topology for all number of nodes of network, every node should have complete details of the topology. This is Centralized algorithm [95][98].

Wireless interference effect cannot be taken into consideration, if running time fast localized distributed algorithm is constant say O(1). It is similar that the complexity is $O(\log^k n)$(where k is a constant) poly-logarithmic algorithm gives the description of the network.

The effect of wireless interference can be handled by linear time localized distributed algorithm. With each node in the network, a token packet is sequentially passed through using this algorithm. Token contains details of the current connected dominating set topology of the neighbour. As the token packet is handled in a sequential manner, there will be no concurrent transmission as well as no packet loss due to interference. Therefore a linear running time is achieved by the algorithm.

**Table 1. Comparison of the different Connected Dominating Set Algorithms**

| Algorithms | Type | Complexity of Time | Complexity of Message | Ratio Performance |
|---|---|---|---|---|
| Marathe | Centralized | -- | -- | 10 |
| GuhaKhuller (1) | do | -- | -- | 2(1+H(Δ)) |
| GuhaKhuller (2) | do | -- | -- | ln Δ + 3 |
| Ruan | do | - | - | 3+ ln (Δ ) |
| Wu | Prune -based | O(Δ ) 3 | θ(n) | n/2 |
| Chen | do | - | - | - |
| Das | Single Initiator | $O(n^2)$ | $O(n^2)$ | 3H ( Δ ) |
| Wan | do | O(n) | O(nlogn) | 8 |
| Cardei | do | O(n) | O(n Δ ) | 8 |
| Cheng | do | O(n) | O(nlogn) | 8 |
| Kim | do | - | - | - |
| Zeng | do | O(n) | O(n) | 7.6 |
| Funke | do | O(n) | $O(n^2)$ | 6.91 |
| Parthasarathy (1) | Multiple Initiators | $O(\Delta \log^2 n)$ | $O(n \log^2 n)$ | - |
| Parthasarathy (2) | do | $O(\log^2 n)$ | O(n log n) | - |
| Li | do | O ( Δ ) | $O(n \Delta^2)$ | 172 |
| Cheng (2) | do | O(n) | O(n) | 147 |

## V. CEDS IN WIRELESS NETWORK

Consider an inadequate algorithm based on Connected EDS based on chosen vertex r say root, any r- CEDS be a Connected EDS r. Issue r-CEDS be through calculate min weight of an r-CEDS. Any undirected graph G = (V,E) within weights about edge w:E→Q+, let $\vec{G} = (V, \vec{E})$ indicate its directed algorithm attained with substituting every edge {u, v} about G through directed individuals, (u,v) also (v,u), with weight w({u,v}). For root r, S⊆V-{r}a non-empty set is said to be dependent set in G. Assume T⊆E is an r-CEDs, also $\vec{T}$ indicates the directed equivalent get by opting for every pair from edges with directed through source node at a leaf node.

Noticeably, $w(T) = w(\vec{T})$ also, here $\vec{T}$ is represented through its characteristic vector $x^{\vec{T}} \in \{0,1\}^{\vec{E}}$, for any $x \in Q^{\vec{E}}$ and $\vec{F} \subseteq \vec{E}$, let $x(\vec{F})\Sigma_{a\in\vec{F}} xa$. Then, $x^{\vec{T}}$ assures linear inequality $x(\delta-(S)) \geq 1$ for every dependent group or sets S ⊆V − {r}, where $\delta-(S) = \{(u,v) \in \vec{E} \mid u \notin S, v \in S\}$, when S set has an edge included, relatively individual arc of _T must go through it. Accordingly, programming linearly issue be recreation of r-CEDS as follows:

### A. Edge Dominating Algorithm

The subsequent algorithm is considered to locate Connected Dominating Set at a graph. Proposed solution algorithm is classified into two sets; first phase has s representation of Total Edge Dominating Set that is constructed as well to make the Total Dominating Set as connected. During the 2nd phase help of connector nodes neighborhood based selection criteria connected edges are found. During the third phase localized search method in implemented to bring down number of edges that are connected to the nodes in the CDS, by making it an optimal solution [13][16].

**Algorithm - Total Edge Dominating set based for Connected Dominating Set**

Input: |V | = n as well as |E| = m,a connected graph G (V, E)
Output: Minimum Connected Edge Dominating Set S ⊆ E.
Initialization: S ← 0; S′ ← 0;

- Graph G(V,E), equivalent edge graph E(G) be formulated also constructed.
- E (G) = (X, Y, E′) where X = E,

Y = E′ be a copy of E
E′ = {(x, y′)/(x, y) ∈ V}

- S′ is partition set along with subset S1, S2,...,Sk such that ∃a edge among any two vertex in Si, i = 1, 2, ..., k
- $C_\alpha$ ← any individual group of $\binom{k}{\alpha}$ Si, i =1, 2, ..., k
- Investigate for common element $e \in \cap\, p \in C_\alpha Bp$ based on set of combination $p \in C_\alpha - S \leftarrow S \cup \{e\}$
- Join the set elements in Cα with last set element of the combination, also include the vertex into the set i.e., assume if e ∈ B1 ∩ B2 for one combination of the sets S1,S2 then S2 = S2 ∪ S1 ∪ {v}
- Local search (V,E,G[S])

**Algorithm : Y–D (X, Y, E′)**
Input: Graph G(V,E) of an Edge graph E (G)
Output: Y - D E (G) = Total EDS of G(V,E)
do

- e = max $_{e\in X}$ N(e)
- S = S ∪ {e}
- X = X – {e}
- Y = Y – N(e)

while Y not equal to 0

**Algorithm 3 LocalSearch (V, E , G[S])**
while S is a connected set, ∀ e ∈ S
B’ = {N[v,w] / (v,w) ∈ S – {e}}
if N[e] – B’ = 0 then
S← S-{e}
else
S←S
endif
endwhile

Algorithm progresses in three different phases as shown.
To begin with the minimum CED Set S is null as well total EDS set S′ appropriate to a graph G be also null.

During first phase, G graph has consequent edge graph E(G) that is constructed as well as its Y-Dominating set is found. By the Theorem 1, the total edge dominating set E′ from a graph G be resulted, and then E is assigned as E′.

In second phase, the TED procedure divides set E′ into different subsets $S_1,S_2,...,S_k$ where every Si’s be connected. Next search for common element e ∈ E – S such that N(e) $\cap S_i \neq 0, 1 \leq i \leq k$. If an element as described earlier exists, then S is reorganized as S ∪ {e}. If not, reiterate the above process for (K□) combinations of $S_i$’s where $2 \leq \alpha \leq k-1$.

In support of resulting a set S is chosen based on the above mentioned condition that are to be satisfied. For any one of the integration or combination in (K□) say p, the resulting element e∈ E – S is added. If $S_1,S_2,...,S_P$ along with e is connected, assigning Sp with Sp∪ {e}. At present $S_p$, $S_{p+1}$, ...,$S_k$ forms a partition of the set S′. The procedure is repetitive unless no occurrence of common element connects at least two subsets. The disconnected sets Si and Sj are searched from the algorithm for the criteria $N(S_i) \cap N(S_j) = 0$ where i = 1 to k − 1 and j = i+1 to k. By neighbourhood local search process, Total Edge Dominating algorithm locates two adjacent edges in E − S such that an edge is adjacent to $S_i$ and another edge adjacent to $S_j$ that result to all set $S_i$’s to be connected.

During third phase, elements that are redundant are removed from S set to give resultant CEDS by applying local search method Algorithm.

### B. Parameters

Performance of every algorithm is in comparison through three routing algorithms; hence to evaluate them certain system requirements have been predefined in the experiment. These predefined values are called as parameter in NS2 as we set them for simulating it is called as simulation parameters. The same values for all the parameters are kept for three routing protocols and for our algorithm.

- Simulation Parameters: Simulation parameters shown in the table 2 explains about the details including the type of channel used, model used are model of radio propagation, network interface type, MAC layer protocol type, queue interface type, link layer type, antenna model type, area of simulation, fixing the speed of every node, maximum number of packet which can traverse in a queue, nodes that can be used for every experiment (vary), time taken for the simulation as the start time is 0s and stop time is 200s fixed for the experiment, type of traffic is CBR as it is a wireless network, protocol used for the experimentation here is AODV, DSDV and DSR, fragment size notify about the packet size framed in byte size along with initial energy preset for every node. The results are even checked for the fragment size varying with 250 bytes, 500 bytes, 1000 bytes and 1500 bytes. These are some of the details to be preset before the start of the experimentation the test bed has to be set in the script.

**Table 2 Different Parameters of Simulation**

| Parameter | Value |
|---|---|
| Channel Type | Channel / Wirelesschannel |
| Model of Radio-Propagation | Propagation / Tworayground |
| Type of Network Interface | Wirelessphy / Phy |
| Type of MAC Layer | IEEE 802_11 / Mac |
| Type of Queue Interface | Drop tail / Queue |
| Type of Link Layer | LL |
| Type of Model Antenna | Omni antenna / Antenna |
| Area of Simulation | 500 x 500 $m^2$ |
| Node Speed | 20 M/S |
| Ifq with Max Packet | 50 |
| Collection of Nodes | 30 |
| Time of Simulation | 200.0s |
| Traffic Type | CBR |
| Routing Protocol | AODV/DSDV/DSR |
| Fragment Size | 250 / 500 / 1000 / 1500 bytes |
| Initial Energy | 100 |

### C. Experimental Results and Discussion

Graphs plotted for the nodes = 30

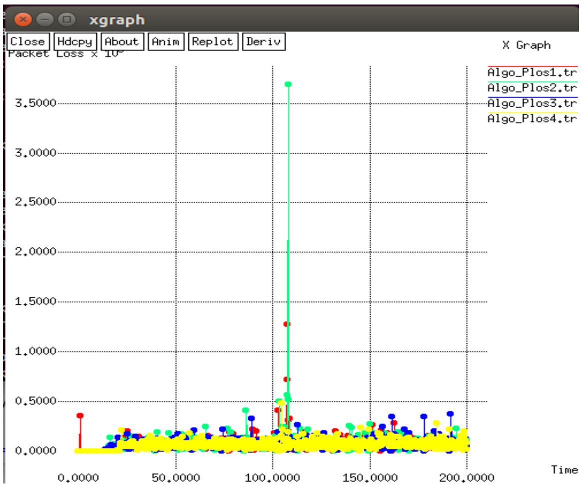



**Fig.5.Xgraph for 30 nodes shows Packet Loss**

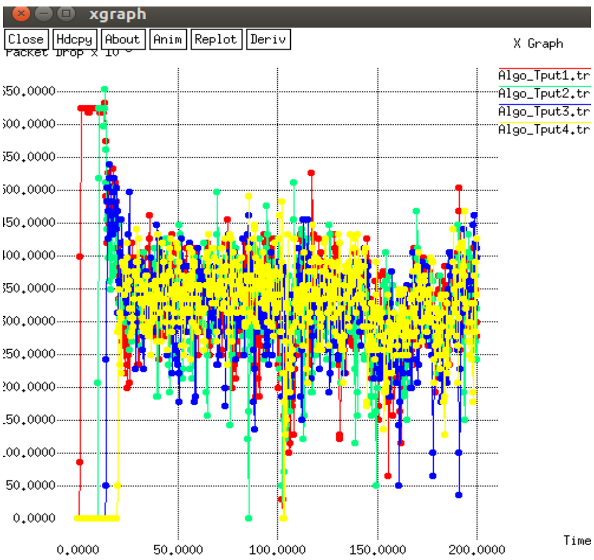



**Fig.6.Xgraph for 30 nodes shows Packet Drop**

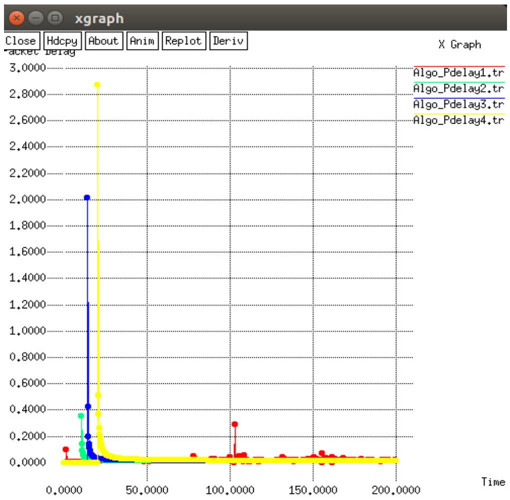
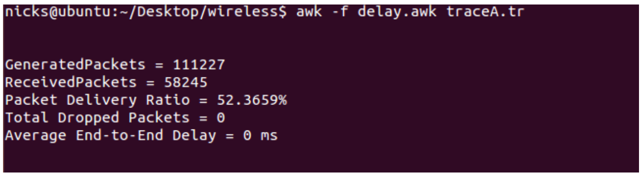



**Fig.7.Xgraph for 30 nodes shows Packet Delay**



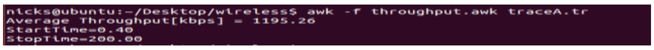




**Fig.8. AWK file output shows about throughput and delivery ratio.**

Fig.5. illustrates that packets are delivered from source to destination node, packets are also lost during congestion. As all the protocols are relaying packets which results in high congestion and hence achieving less delivery ratio. At 110sec time AODV protocol shows packet loss due to high congestion in the network and DSDV shows packet loss at the same second. DSR algorithm shows packet loss during the 150 to 200 sec time. There is less packet loss with our algorithm, which achieve packet delivery ratio compared to AODV and DSDV protocol.

Packet drop can be for reasons like end of simulation, collision, packet error, if the MAC is busy. If there is no route to forward, it can also be for expiry of packet and can be dropped by ARP. Fig.6. illustrates that packets drop in the network that is en route for delivery from starting node to end node. The reason for drop of packet can be different reasons which are discussed. When protocols are relaying packets at a particular time it results in drop of packets hence not reaching the destination node. In the initial time we can see AODV and DSDV protocol there is lot of packet drop. Even the DSR algorithm results in drop from 20sec and above time. Comparatively, our algorithm starts the drop of packet at a later time and has fewer drops of packets.

Fig.7. illustrate the time it takes for the packets as of source node to end node on the way to reach. As the number of nodes considered during experiment is 30 in number the packet delay is high some time and during the time we can see the delay is less.

Fig.8. shows that AWK file has generated output based on the trace files generated. AWK file evaluates the trace file data-set and then results as above.

It gives details of generated packets, received packets, delivery ratio of the packets, total packets dropped, average e2e delay and average throughput of our algorithm including start and stop time of simulation.

## VI. CONCLUSION

Here different algorithmic approaches in dominating set are explained with their performance in terms of theorems, proof for them, proposition and corollary. Approximation distributed algorithm in CDS various approaches have been clarified. Before working on the CEDS, much of work was done on CDS. The difference between each says that CEDS results on edge set work as well as CDS results in vertex set work. During research of vertex set on CDS, study resulted with better performance for new algorithmic approach. Similarly, novel approach on connected edge dominating set proposed upshot better performance results compared to the CDS approach. Results for the performance compared through representation using xgraphs. NS2 gives a best provision to write the results with pictorial way. In the network created study has been on 30 nodes along with different parameters considered for a time period of 200ms.

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