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Performance of AOMDV & DSDV with Congestion Control for Multipath Routing in WSN

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Abstract—The congestion problem in Wireless Sensor Networks (WSNs) is quite different from other networks. The congestion control algorithms try to all the congestion by reducing the rate at which the source nodes inject packets into the network. In most of the existing works either detection of congestion or scheme for congestion control in wireless sensor networks are presented. A very few works have taken in to account of both congestion detection and congestion control. The congestion control using multipath routing in wireless network is performed by the performance metrics. Multipath routing is an efficient technique to route data in wireless sensor networks (WSNs). From review will implement multipath routing in wireless sensor network & evaluating the performance metrics to control the congestion. In wireless sensor network congestion is controlled by the throughput, delay & energy. In this paper the network formation is formed by the nodes, & multipath routing in wireless sensor network is show by output.

Keywords*- Congestion control, Multipath routing, WSN.*

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1. INTRODUCTION

[A]Wireless sensor network

The WSN is built of "nodes" from a few to several hundreds or thousands, where each node is connected to one sensors. Each such sensor network node has typically several parts [1]. A Wireless sensor network (WSN) is a set of tiny nodes that are equipped with embedded computing devices interfacing with sensors/actuators. They generally use short range wireless transmitters and they act autonomously but cooperatively to route data, hop-by-hop towards a central node called sink, or base station. The development of wireless sensor networks was motivated by military applications such as battlefield surveillance; today such networks are used in many industrial and consumer applications, such as industrial process monitoring and control, machine health monitoring, and so on. A WSN comprises a large set of distributed nodes over a wide geographical (indoor or outdoor) area to monitor a physical or environmental event With the emergence of IoT (Internet of Things), WSN becomes more and more attractive by their integration in a real world of interconnected objects through internet.

[B] Multipath Routing

Multipath routing is the routing technique of using multiple alternative paths in a network, which can yield a different type of benefits such as tolerance, increase bandwidth or improved security. The multiple paths compute might be overlapped, edge-disjointed or node-disjointed with each other. The Multipath routing is an efficient technique to route data in wireless sensor networks (WSNs) because it can provide reliability and load balance, which are especially critical in the resource constrained system such as WSNs.. The multipath routing technique which has demonstrated its efficiency to improve wireless sensor performance is efficiently used to find alternate paths between sources and destination. This approach is considered as one of the existing solutions to cope with the limitations of routing . In this section, the benefits and elements of multipath routing will be explained. The different multipath routing protocols are as fallows AOMDV,ORMAD ,I2MR, SMR. Multipath routing is an alternative routing technique, which selects multiple paths to deliver data from source to destination.

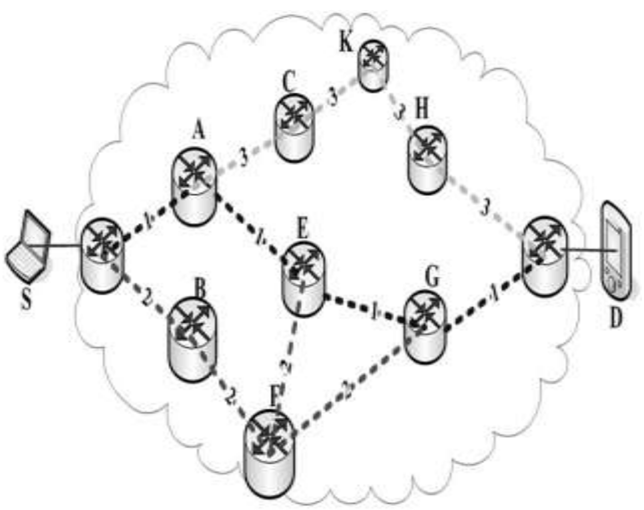


Fig.1 Basic diagram of multipath routing

[C]Congestion control

Congestion is an important issue that can arise packet switched network. Congestion is situation in Communication Networks in which too many packets are present in a part of the subnet performance degrades. Congestion Control refers to techniques and mechanisms that can either prevent congestion, before it happens, or remove congestion, after it has happened. When one part of the subnet becomes overloaded, congestion results.[2] Congestion in Wireless Sensor Networks (WSNs) has negative impact on the performance, namely, decreased throughput and increased per-packet energy consumption, The congestion problem in WSNs is quite different from traditional networks. Congestion can occur due to several reasons. For example, if all of a sudden a stream of packets arrive on several input lines and need to be out on the same output line, then a long queue will be build up for that output. . If there is insufficient memory to hold these packets, then packets will be lost (dropped). Congestion affects two vital parameters of the network performance, namely throughput and delay, Initially throughput increases linearly with offered load, because utilization of the network increases.

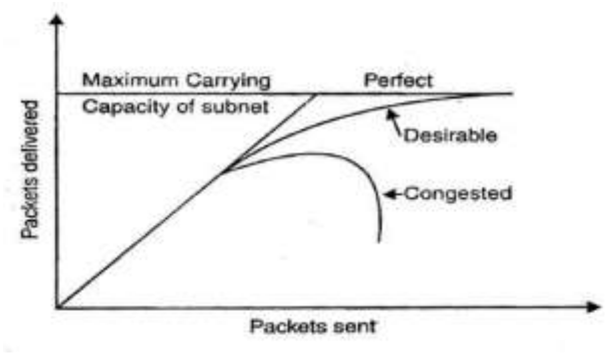


Fig:-2 Concept of congestion

[D] AOMDV ROUTING PROTOCOL

In each route discovery, find multiple routes between source and destination. Use alternate routes on a route failure. New route discovery needed only when all routes fail. number of route discoveries. Reduction in delay and routing overhead. AOMDV is designed to calculate multiple paths during the route discovery in highly dynamic ad hoc networks where the link breakage occurs frequently due to high velocity of vehicles. In AOMDV, performing the route discovery procedure will be done after all paths to either source or destination fail. In AOMDV routing protocol, it is endeavored to utilize the routing information already available in the underlying AODV protocol. AOMDV protocol is an extended version of AODV protocol for computing multiple loop-free and link disjoint paths.

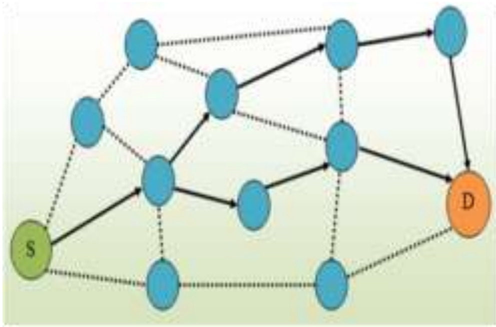
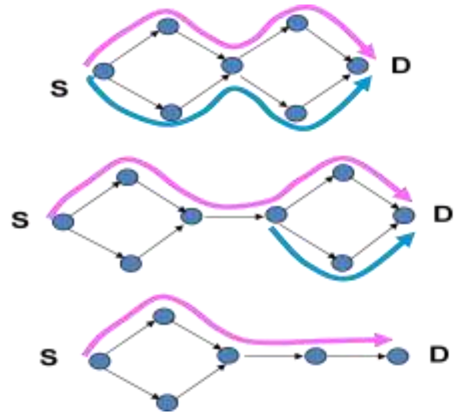


Fig:- 3 AOMDV Routing Structure



Fig;-4 Finding Link-disjoint Path

[E] Destination Sequenced Distance Vector (DSDV)

The number is generated by the destination, and the emitter needs to send out the next update with this number. Routing information is distributed between nodes by sending full dumps infrequently and smaller incremental updates more frequently.Thus formentioned discussed routing protocols are all reactive protocols in which the routes are established on demands. DSDV is a proactive routing protocol which maintains the route to the destination before it is required to be established. Therefore, each node maintains a routing table including next hop, cost metric towards the destination node and the sequence number generated by the destination node. The DSDV mechanism incurs large volume of control traffic in highly dynamic networks which results in experiencing a considerable amount of bandwidth consumed.

2. LITERATURE REVIEW

The work proposed in [1] of IEEE transaction by Shancang Li, Shanshan Zhao, Xinheng Wang, Kewang Zhang, and Ling Li shows that evaluation metric, path vacant ratio, is proposed to evaluate and then find a set of link-disjoint paths from all available paths. A congestion control algorithm that can adaptively adjust the load over multipaths is proposed. A threshold sharing algorithm is applied to split the packets into multiple segments that will be delivered via multipath to the destination depending on the path vacant

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ratio. Multipath routing protocols such as ad hoc on-demand multipath distance vector (AOMDV) Temporally Ordered Routing Algorithm (TORA), on-demand multiple route maintenance in AODV extensions (ORMAD) and interference minimized multipath routing (I2MR) are the most common examples in ad hoc networks. In the paper [2] Fengyuan Ren, Sajal K. Das and Chuang Lin propose a traffic-aware dynamic routing (TADR) algorithm to route packets around the congestion areas and scatter the excessive packets along multiple paths where the idle or under loaded nodes are sufficiently utilized in response to congestion under the fidelity requirements. present a solution that sufficiently exerts the idle or under loaded nodes to alleviate congestion and improve the overall throughput in WSNs. The congestion problem in Wireless Sensor Networks (WSNs) is quite different from that in traditional networks. In the paper [3] Claudio Estevez Ethernet-Services Transport Protocol (ESTP) has proven relieve the effects of the decrease algorithm by dynamically adjusting the transmission rate according to the level of congestion estimated in the network. It should be emphasized that most protocols detect congestion, but do not estimate the level of congestion. In the paper [4] Fernando Paganini and Enrique Mallada use TCP-FAST for congestion control and develop a multipath variant of the distance vector routing protocol RIP. Author demonstrate through simulations the collective behavior of the system, in particular that it reaches the desired equilibrium points of the distance vector routing protocol RIP. In particular that it reaches the desired equilibrium points. In the paper [5] Lucian Popa , Costin Raiciu approach consists of a multipath routing protocol, Biased Geographical Routing (BGR), and two congestion control algorithms, In-Network Packet Scatter (IPS) and End-to-End Packet Scatter (EPS), which leverage BGR to avoid the congested areas of the network. Author propose a solution to improve fairness and increase throughput in wireless networks with location information.

3. METHODS OF CONGESTION CONTROL

1.Congestion Detection

The detection mechanism is based on buffer occupancy and wireless usage, exponentially averaged to eliminate noise. Wireless usage is measured by periodically sampling wireless medium. detects congestion by measuring the queue length. It controls congestion by combining the techniques i.e; hop-by-hop flow control, source rate limiting. Fusion claims to achieve good throughput and fairness at high offered load. Here, an efficient congestion control scheme will be proposed, which is able to adaptively schedule the load distributive to multiple paths and reduce the congestion on multipaths to avoid packet loss and thus enhance the throughput, security, and reliability of traffic.[3]The proposed congestion detection scheme can provide service ratio and congestion notification when it occurs.

2.Congestion control & notification

A hop-by-hop rate adjustment mechanism to tune the congestion on multipaths, where the output rate at a node on a particular path m is controlled by adjusting a scheduling rate Risch. The scheduling rate is defined as how many packets are scheduled at a time interval from the priority queues on a particular path e.g., if node ni has n parent nodes, then the scheduling rate at node. By doing this, the packet loss can be decreased. In this design, a congestion notification scheme is used, in which each node ni is able to piggyback the packet scheduling rate Rsch, the number of child nodes C, and the packet service rate Rs in the packet header. The scheduling rate is defined as how many packets are scheduled at a time interval from the priority queues on a particular path.

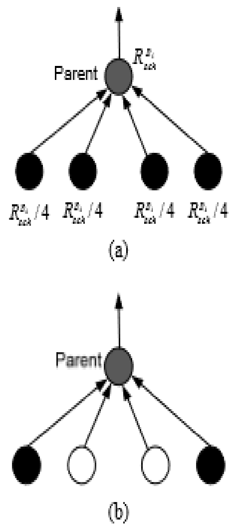

Fig:-5. Any of the child nodes is termed as i , & the grey coloured node is the parent of i,a)all child nodes are active (black coloured nodes)b)two child nodes are idle (white).

3.Congestion cancellation

The congestion cancellation procedure empties its buffer and reduces the amount of backlogged data packets to allow the current data packet to be transmitted before sending the CONGEST message to the source node. When a CONGEST packet is received by the source node, the delivery rate is adjusted to a lower pre defined rate.[4]

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4. CONGESTION DETECTION & CONGESTION CONTROL

In the Congestion detection module the number nodes are formed in a network. The network formation show the communication between the nodes i.e from source to destination. The number of nodes show the network is small or long. The formation of network show the position of nodes.

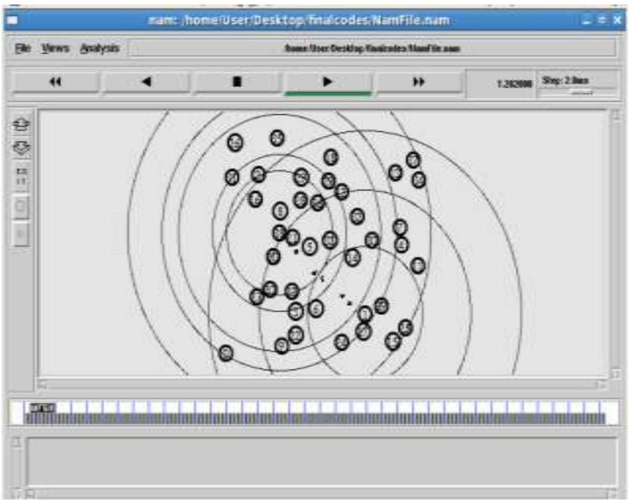


Fig :-6 Congestion detection with data transfer

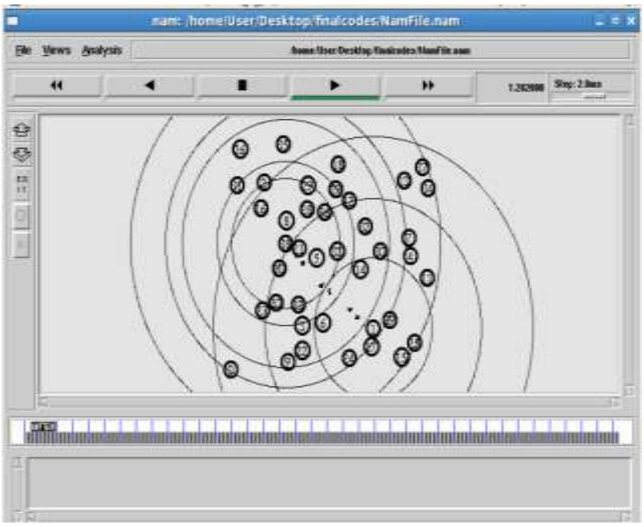


Fig:-7 Congestion control

5 .PERFORMANCE METRICS:-

Performance metrics related to congestion control as fallows:-

Throughput:-The throughput can be defined as the percentage utilization of the network capacity.

Packet Lost : -The total number of packets dropped during the simulation.

Packet lost = Number of packet send – Number of packet received .The lower value of the packet lost means the better performance of the protocol.

Packet delivery ratio :- The ratio of the number of delivered data packet to the destination. This illustrates the level of delivered data to the destination.∑ Number of packet receive / ∑ Number of packet send.The greater value of packet delivery ratio means the better performance of the protocol

Delay :- The average time taken by a data packet to arrive in the destination.

∑ (arrive time – send time) / ∑ Number of connections. The lower value of end to end delay means the better performance of the protocol.

The performance metrics shows performance of the protocol which is used in the network .The performance metrics shows the occurrence of the terms Delay, throughput, Energy. And shows the better performance of the protocol in wireless sensor network.

Simulation parameter table:-

Table:-Simulation parameter which is found in a output window during network & multipath routing

Protocol	**AOMDV, DSDV**
Traffic type	CBR(UDP)
Simulation area	300×300m
Packet size	1000
Packet rate	10m/sec
Number of nodes	40
Maximum packets	50
Simulation duration	43 sec

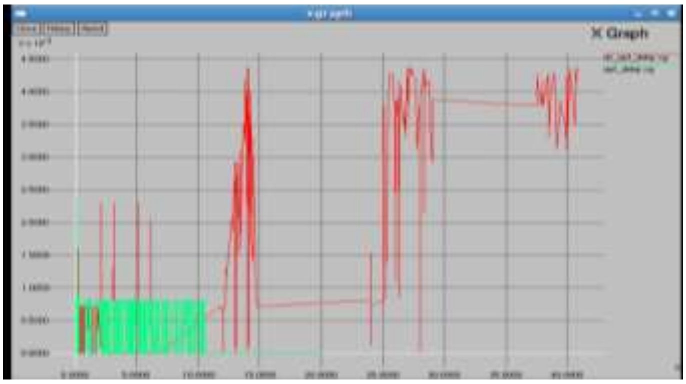
In this paper the congestion control methods are describe for the occurrence of congestion in a network. The fig shows the concept of congestion control .The multipath routing is explain by the basic fig of multipath routing. The multipath routing is routing for multiple paths between source to destination in the network.The congestion caused buffer overflow in the node and can result in packet loss .Another is link level congestion that is related to the wireless channel shared by several nodes. congestion in wireless sensor network has negative impact on the performance, namely, decreased throughput & increased per- packet energy consumption. In the paper the wireless sensor network using multipath routing is shown by output.

Simulation Results

1.Comparison of two Protocols AOMDV & DSDV without & with congestion control of Average Delay

Simulation time	Average Delay			
	Without congestion control		With congestion control	
	AOMDV	DSDV	AOMDV	DSDV
5msec	1.0msec	2.3mse	0.8msec	1.0msec
10msec	1.0msec	2.3msec	0.8msec	2.0msec
15msec	0.9msec	2.2msec	0.8msec	2.5msec
20msec	0.9msec	1.8msec	0.8msec	0.9msec
25msec	0.9msec	2.2msec	0.8msec	2.8msec
30msec	0.8msec	1.4msec	0.8msec	3.5msec
35msec	0.8msec	3.4msec	0.8msec	3.8msec
40msec	0.8msec	1msec	0.8msec	4.3msec

Simulation time Vs Avg delay with congestion control of AOMDV & DSDV

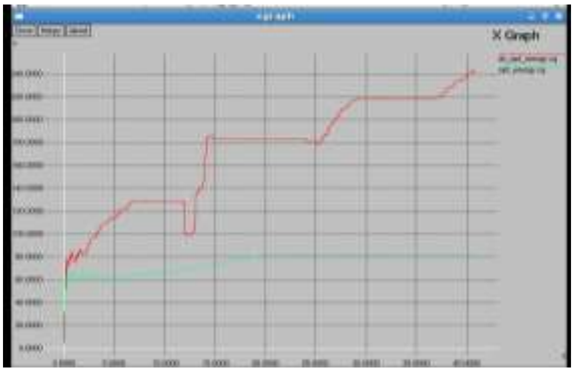


Analysis:- The above Xgraph shows graph of Avg Delay using AOMDV & DSDV routing Protocol. In which the red line indicates Avg delay of DSDV t & green line indicates Avg delay of AOMDV with congestion control.

2. Comparison of two Protocols AOMDV & DSDV without & with congestion control of Energy

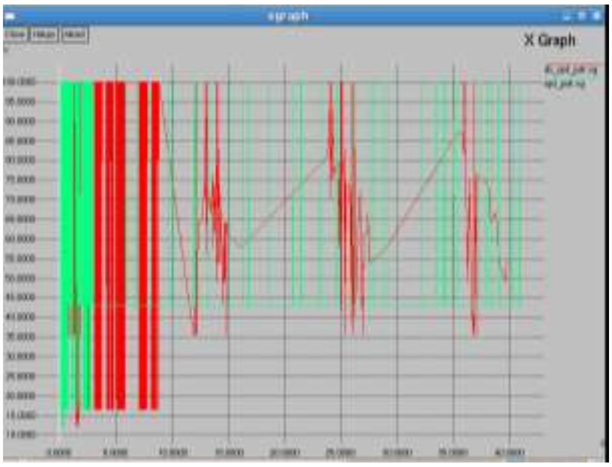
Simulation time	Energy			
	Without congestion control		With congestion control	
	AOMDV	DSDV	AOMDV	DSDV
5msec	63mj	113mj	62mj	113mj
10msec	65mj	121mj	65mj	125mj
15msec	72mj	123mj	72mj	140mj
20msec	80mj	125mj	80mj	180mj
25msec	82mj	131mj	80mj	181mj
30msec	82mj	130mj	80mj	200mj
35msec	82mj	131mj	80mj	220mj
40msec	81mj	135mj	80mj	240mj

Simulation time vs Energy with congestion control of AOMDV & DSDV



Analysis:-The above Xgraph is of Energy with congestion control using AOMDV & DSDV.In the xgraph the green line indicate the Energy of AOMDV & Red line indicates the energy of DSDV .The Xgraph is of Energy with simulation time Vs Energy. AOMDV perform much better than DSDV in terms of energy .The lower value of Energy means the better performance of the protocol

3. Comparison of two Protocols AOMDV & DSDV without & with congestion control of packet delivery ratio.



With Congestion Control using AOMDV & DSDV of PDR

Analysis:-The above Xgraph is of PDR with congestion control using AOMDV & DSDV. In the xgraph the green line indicate the PDR of AOMDV& Red line indicates the PDR of DSDV

With Congestion Control using AOMDV & DSDV of PDR

Simulation time	Packet Delivery Ratio			
	Without congestion control		With congestion control	
	AOMDV	DSDV	AOMDV	DSDV
5msec	96.96%	95.94%	99.96%	97.90%
10msec	96.76%	95.72%	99.86%	97.89%
15msec	96.66%	95.23%	99.77%	97.72%
20msec	96.23%	94.55%	99.65%	97.56%
25msec	95.78%	94.23%	99.54%	97.45%
30msec	95.56%	93.23%	99.43%	97.23%
35msec	95.43%	92.54%	99.32%	97.18%
40msec	95.23%	91.45%	99.27%	97.1%

6. CONCLISION:-

In this paper we have present an efficient multipath routing mechanism for congestion control in wireless sensor network .We performed performance metrics like i) throughput ii) routing delay iii)Energy efficiency. in wireless sensor network. we have evaluated multipath routing protocols (AOMDV, DSDV) for WSN which uses congestion control scheme like congestion detection, congestion control & congestion cancellation through NS2 Network simulation. We have simulated the performance of AOMDV and DSDV routing protocols without & with congestion control using performance metrics like Average delay ,Energy & Packet delivery ratio. We have analyzed that AOMDV is best Routing protocol to control the congestion for multipath routing in WSN as compared to the DSDV routing protocol with respect to performance metrics.

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