Throughput Enhancement using CDS Based Dijkstra's Technique In Wireless Mesh Networks

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Abstract

Wireless mesh networks are absolutely necessary in our day to day lives. Because of it's excessive reliability, low placement costs, and adaptability, wireless mesh networks had a considerable advancement in recent years. Wireless mesh networks gives excess broadband access to a vast number of users. Network coding is extremely applicable for WMN. To increase the throughput of a system network coding can be effectively used, by utilizing some scientific operations which reduces the number of transmissions. Larger end to end delay is a harsh problem in a network flow and it will reduce the network performance .To avoid this problem, routing should be depicted with an ideal coding opportunity path.A coding agent having optimum coding opportunity with CDS preference can be used to find the best routing path with CDS preference. This work proposes a Connected dominating set (CDS) based Dijkstra's algorithm to enhance the throughput of a network.CDS based Dijkstra's technique outperforms the existing CDS based FCR technique in terms of increased throughput and lowest end to end delay.

Keywords—*Network coding,Connected Dominating Set,Dijkstra's Technique.*

I. INTRODUCTION

Network coding is a communication technique which can provide enhancement in throughput and a very high efficiency. Network coding properly mix data packets using some mathematical techniques. It can reduce the number of transmissions in data packet forwarding. If the routing is based with an efficient optimum path we can improve the performance of the system. Many researchers consider it as an efficient technology for wireless mesh networks. Network throughput can efficiently increase coding opportunities with less end to end delay and enhanced throughput. Through accurate measurement of routing parameters, CDS based Dijkstra's technique can achieve a better transmission of packets via the best shortest path. And it can easily decide an optimum coding opportunity in the path. Main steps involved in this work are Creation of two network flows, find CDS routing nodes, Apply CDS based FCR and CDS based Dijkstra's technique, compare the routing parameters for both techniques etc. Comparison can be done with end to end delay and throughput parameters.

II .LITERATURE REVIEW

Many schemes established with the idea of network coding which is more convenient to wireless mesh networks. An opportunistic coding approach is proposed in [1].This technique can be implemented with opportunistic coding scheme and opportunistic noticing scheme. This technique is applicable for two hop region only. In this work throughput is increased.

An efficient network coding aware routing scheme NCAR is proposed in [2].A suitable coding solution is presented in this work, when more than one flow stands. Path availability, path selection steps are involved in this work. Coding opportunity is significantly improved in this work.

Distributed coding aware routing scheme is proposed in[3].This technique is fully based on the coding opportunity. It identifies all possible paths in between sender and receiver. The potential coding opportunities presented in this paper is based on the flow of network traffic.

An adaptive packet control scheme, ACPO is proposed in[4].An adaptive W scheme in this work improves the network throughput. In this work waiting interval of heard data packets in a flow is controlled. Waiting interval of this scheme is modified with a specific duration. This work is applicable with two hop region only.In this work packet overhead is significantly reduced.

Many existing schemes based on network coding considers coding opportunity.But there is a performance degradation in terms throughput and end to end delay.And some of the existing schemes having two hop region limitation.To compensate the demerits of the existing schemes,CDS based Dijkstra's algorithm can be used.

III . PROPOSED APPROACH

A .Connected Dominating Set

Connected Dominating Set is a part of graph theory. We can assume the nodes in a network as a part of a graph. Consider

$$G= (V, E)$$

Where G is the graph, V represents the vertex node set and E represents the edge node set. Consider vertices'D' in a graph which must satisfy the following properties.

- A node in 'D' can attain any other node in'D'via a route which belongs to'D'. It means 'D' makes a connected subgraph of G.
- Each vertex in G belongs to'D' otherwise which is adjacent to a vertex in'D'.Then 'D' is a dominating set of G.

For example consider a CDS set in figure 1.First select one source and destination. Let 16 be the destination and 12 be the souce.There are many ways to reach from source 16 to destination 12.To get an efficient path we can select a CDS routing path. In this 18, 10, 8, 5, 4 are the connected dominating set nodes. In this figure 16-18-10-8-12 is a CDS routing.16-18-13-12 is not a CDS routing. It's because 11 is not a CDS node.Dominating nodes can easily cover structure of wireless mesh network. It can act a wireless backbone in networking.

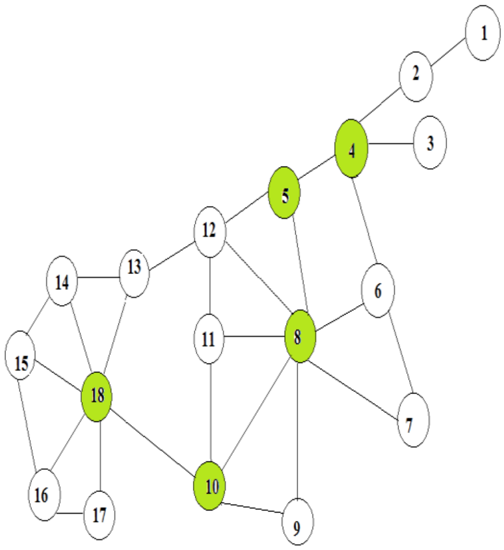

Fig.1: Connected Dominating Set

B . CDS Based Dijkstra's Technique

We have to find the most efficient path to packet transfer. To find an optimum coding opportunity path CDS is one of the best option, which having more number of edges in the network. We can use CDS based Dijkstra's technique to improve the performance of the shortest path.

In this technique, first create two flows with 17 nodes. All 17 nodes are deployed in a random manner. Two source nodes and to destination nodes are created here. Now we have to find a suitable efficient shortest path. Since CDS is a better way to cover the topology of WMNs, we have to find the connected dominating set nodes. To check a connected dominating set node routing first calculating their node degree. The degree of a node is is the number of edges connected to the node. Choose the middle range value from the all available degrees as a threshold value. Here iam considering the nodes whose node degree greater than five as dominating nodes. For a node, the number of backward and forward nodes are matching that node will be the coding agent. For two flows which meets at coding agent node, if the following conditions are satisfied; First condition is,the destination node 1 should be the back warding node of the coding agent in the first flow and at the same time the destination node 1 should be the single hop neighbor of the source node 2,which is the forwarding node of the coding agent in the second flow. Second condition is, the destination node 2 should be the back warding node of the coding agent in second flow and at the same time destination node 2 should be the single hop neighbor of the source node 1, which is the forwarding node of the coding agent in first flow. If these two conditions are matching there will be a coding agent for flow 1 and 2.Next step in this technique is to find the gamma ratio.

$$\gamma = r1/r2$$

If the event is 'receive' then find the length of the coding agent and two source nodes. These two length's matching factor is gamma ratio. Next , find the shortest CDS based FCR value path with the help of gamma ratio. And compare the hop count of the CFCR value path for two flows. If the hop count of the CFCR1 is smaller means first flow is the shortest value path and vice versa. Apply Dijkstra's algorithm to the smallest value path, to further reduce number of hops between source and destination. Now we can send packet via the efficient shortest path with high throughput and less end to end delay .Compare the CDS based FCR shortest path with CDS based Dijktra' technique.

The flow of the proposed system is shown in figure.2.The technique used here is Dijkstra which is the shortest path algorithm. This algorithm considers the unaccessed node with a shortest distance and it finds the path through it to each unaccessed neighbor vertex.And it updates each neighbor vertex's distance. When the desired destination is reached then we can stop the process. Dijkstra's technique further reduces the number of hops in the flow.

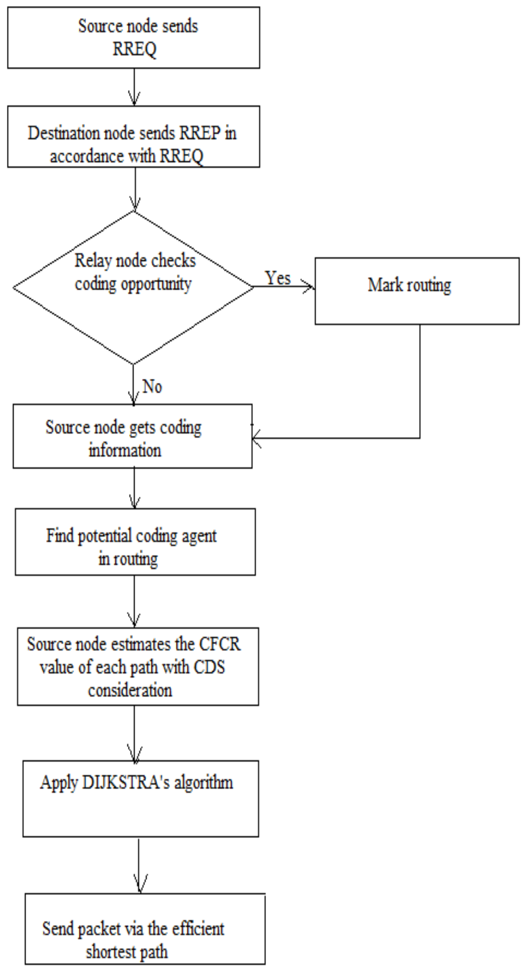

Fig.2 Proposed system

C. Implementation of The Proposed System

Here iam using ns2 to simulate the tcl script. Implementation of simulation parameters are discussed in table 1.

PARAMETER	VALUE
Version	Ns-allinone-2.35
Propagation model	Two-ray
Traffic model	UDP,CBR
Routing protocol	DSR
Number of nodes	17
Antenna type	Omni-directional

Table 1: Simulation Parameters

IV .RESULTS AND ANALYSIS

The results obtained after simulation using ns2 is discussed in this section. End to end delay and throughput performance are discussed in this section.

Throughput =Total bytes received/Current time instance.

The throughput performance is improved in the proposed scheme than the existing scheme (fig.3).Blue line indicates throughput of the proposed scheme.

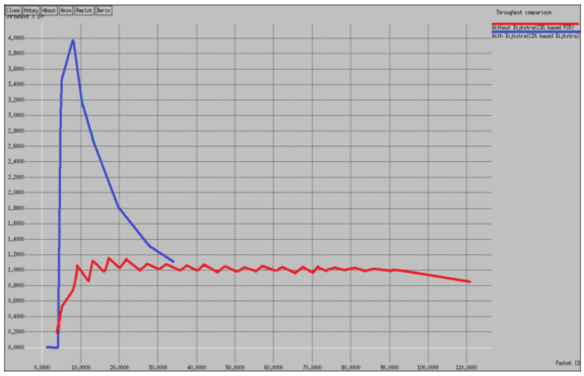

Fig.3:Throughput comparison

A less end to end delay is achieved in the proposed scheme than the existing scheme.(fig.4)Blue line indicates a very less end to end delay of the proposed scheme. End to end delay is the time taken for a packet to reach from the source to destination.

End to end delay=End time-start time

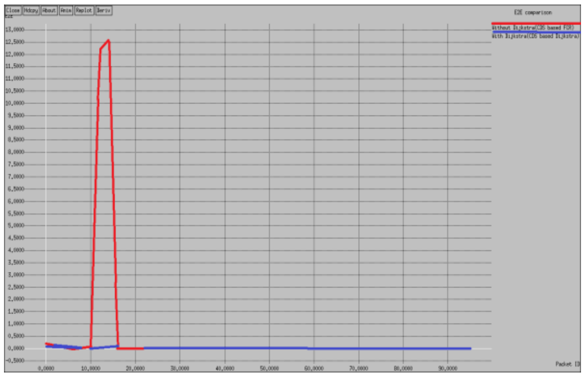

Fig.4:End to end delay comparison

Throughput and end to end delay of the existing and proposed systems are discussed here.Comparison of both systems are given in table 2.CDS based Dijkstra's technique outperforms the existing system.

Parameter	CDS Based FCR	CDS Based Dijkstra
End to end delay	More	Less
Throughput	Increased	Further increased

Table 2: Comparison table

V .CONCLUSION AND FUTURE SCOPE

A CDS based Dijkstra's throughput enhancement scheme is proposed in this work. This scheme outperforms the existing system in terms of end to end delay and throughput. A better throughput enhancement is achieved by suitable shortest path data forwarding. Currently, this work associated with two flows in a network. In future, this technique can be implemented with more than two flows with reduced coding collision and enhanced throughput.

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