Implementation & Latency Analysis of Perfect Difference Network (PDN) in Wired Environment

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Abstract: This paper is based on simulation of the Perfect Difference Network (PDN) using NS2 (Network simulator) for 7 and 13nodes and node 21,later analysis of latency . During implementation we have tried to make disturbance in the network to better analysis of PDN implementation in wired network. PDN is asympotically connection of node in which any node is reachable to another in one or two hops at most .

Keywords: *Perfect Difference Network, Perfect Difference Network, Latency , Wired Network,*

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1.INTRODUCTION

Network latency is the term used to indicate any kind of delay that happens in data communication over a network. Network connections in which small delays occur are called low-latency networks whereas network connections which suffers from long delays are called high-latency networks. Latency is amount of time a message take to transvese a system ,it is an expression of how much time it takes for a packet of data to get from one designed point to another ,it is some time measured as the time required for a packet to be returned to its sender. A low latency indicate high network efficiency.latency is the fundamental measure of Network performance.latency measure the amount of time betweeen start and completion of an action.sending data in an large packet has higher throughput than sending data in an smallu packet both because of small number of packet header and because of reduced start up and queuing latency .If the data is streamed propogation latency has little effort on throughput but if the system waits for an acknowledgment after each packet before sending the another packet resulting high propogation latency will greatly reduced throughput.

The n-node complete graph and the n-node ring represent the two extremes of network connectivity patterns. intermediate architectures between n-node complete graph connectivity and n-node ring connectivity can be obtained in a variety of ways, providing tradeoffs in cost and performance. Network cost is affected, among othe r things, by the (maximum) node degree d, while indicators of network performance and network cost. Perfect difference network is one such network which is based on the concept of perfect difference sets .

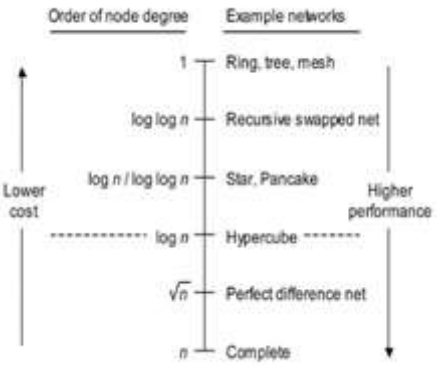


Fig 1. Various network with node degree & cost

2. Perfect Difference Set (PDS)

Perfect Difference set is mathematical tool for calculating optimizing number node in asymptotic manner for perfect difference Network [2].Perfect difference sets were first Discussed by J. Singer in 1938 in terms of points and lines in a finite projective planes [3]. Perfect Difference Set (PDS) – A set { s0, s1, ... , sδ }of δ + 1 integers having the property that their δ2 + δ differences si– sj, 0 ≤ i≠ j ≤ δ, are congruent, modulo (δ2 +δ + 1), to the integers 1, 2, . . . , δ2 + δ in some order is a perfect difference set of order δ. Perfect difference sets are sometimes called simple difference sets. Perfect Difference sets with order δ as a power of prime number and number of nodes, n= δ2 + δ + 1. PDS need not contain an integer outside the interval [0, δ2+ δ], because any integer outside the interval can be replaced by another integer in the interval without affecting the defining property of the PDS [3].Perfect Difference Set { s0, s1, . . . , sδ} is reduced to normal PDS if it contains the integers 0 and .A reduced PDS is in normal form if it

satisfies si<si+1 ≤ δ2 + δ, 0 ≤ i<δ.

δ	n	Example PDS of order δ in normal form
2	7	0, 1, 3
3	13	0, 1, 3, 9
4	21	0, 1, 4, 14, 16
5	31	0, 1, 3, 8, 12, 18
7	57	0, 1, 3, 13, 32, 36, 43, 52
8	73	0, 1, 3, 7, 15, 31, 36, 54, 63
9	91	0, 1, 3, 9, 27, 49, 56, 61, 77, 81
11	133	0, 1, 3, 12, 20, 34, 38, 81, 88, 94, 104, 109
13	183	0, 1, 3, 16, 23, 28, 42, 76, 82, 86, 119, 137, 154, 175
16	273	0, 1, 3, 7, 15, 31, 63, 90, 116, 127, 136, 181, 194, 204, 233, 238, 255

Fig2. Example of PDS

3. Perfect difference Network (PDN)

Perfect difference network is depended on the mathematical notion of perfect difference set. Consider the normal-form PDS {0, 1, s2, . . . , s δ } of order δ. We can construct a direct network with n = δ 2 + δ + 1 nodes based on this PDS.

Definition 1: Perfect difference network (PDN) based on the PDS {0, 1, s2, . . . , s δ } – There are n = δ 2 + δ + 1nodes, numbered 0 to n – 1. Node i is connected via directed links to nodes i ±□ 1 and i ±□ si(mod n), for 2δ□ i< ≤□ . Because all index expressions in this paper are evaluated modulo n, henceforth we will delete the qualifier "mod n." The preceding connectivity leads to a chordal ring of in- and out-degree d = 2≤□ and diameter D = 2. Because for each link from node i to node j, the reverse link (j, i) also exists, the network corresponds to an undirected graph. Fig 2 and fig.3 shows graphical representation of Perfect Difference Network of δ=2,3.

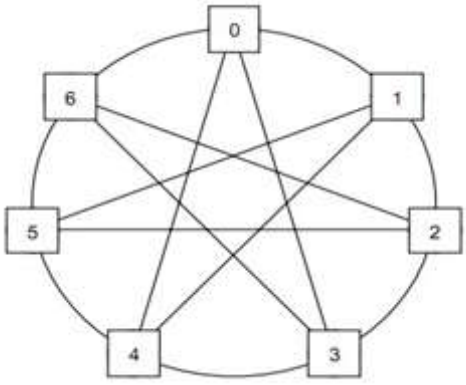


Fig. 2. PDN with n = 7 nodes based on the perfect set {0,1,3}

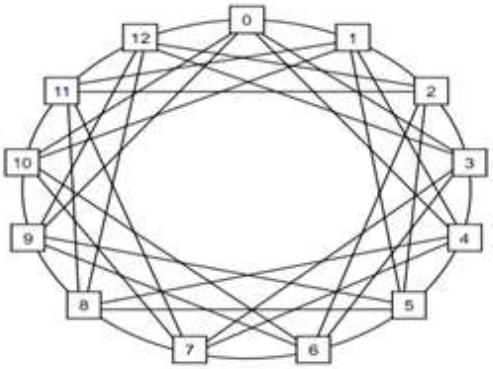
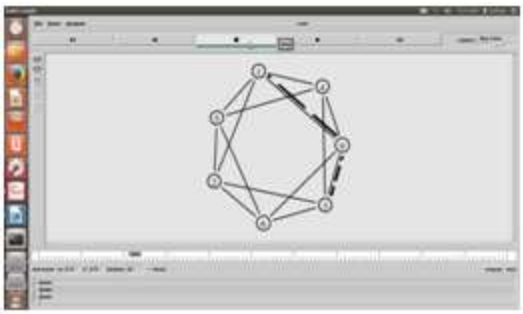


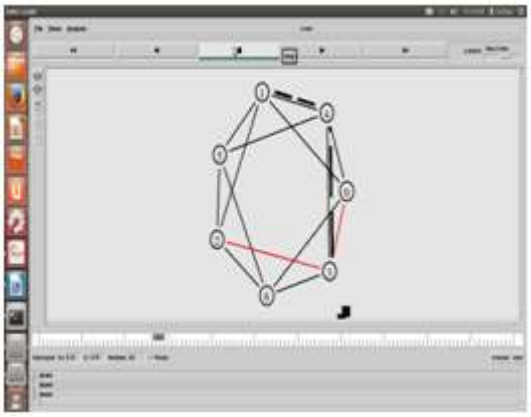
Fig. 3 PDN with n = 13 nodes based on the perfect set {0,1,3,9}

4. Experimental Evaluation

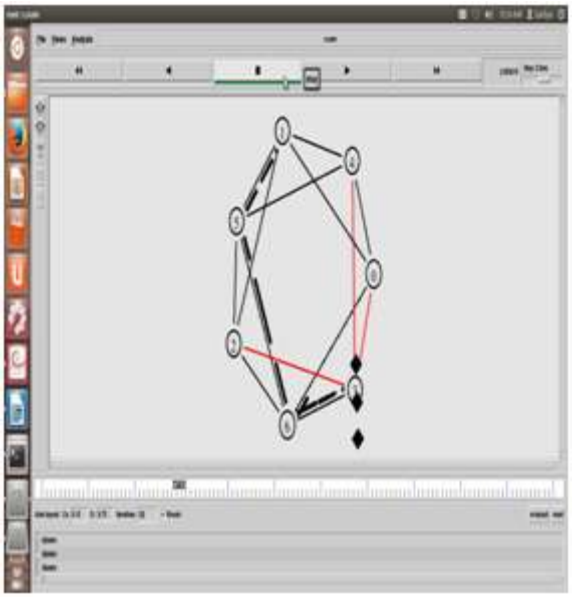
we had implemented PDN in wired enviornment and result shows that communication occur between nodes at two hops 1. Packets are moving from node 1 -0-3 i.e for node 1 as source and node 3 as destination



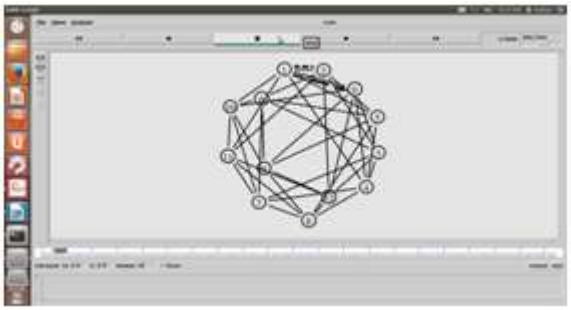
2. Link between node 1and node3 get fail communication occur via path 1-4-3 i.e node 1 as source and node 3 as a destination node .



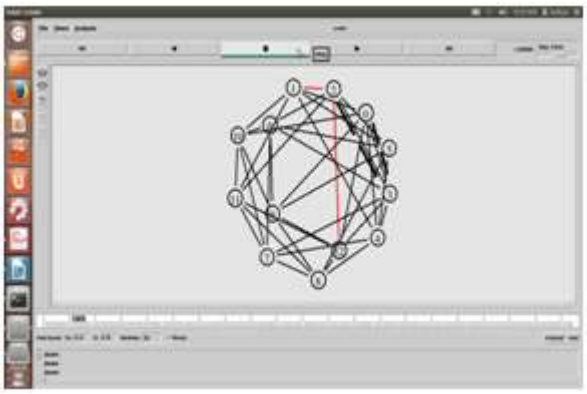
3. For source node 1 and destination node 3 for path 1-5-6-3. Here all link get fail but still communication done between node 1 and node 3.



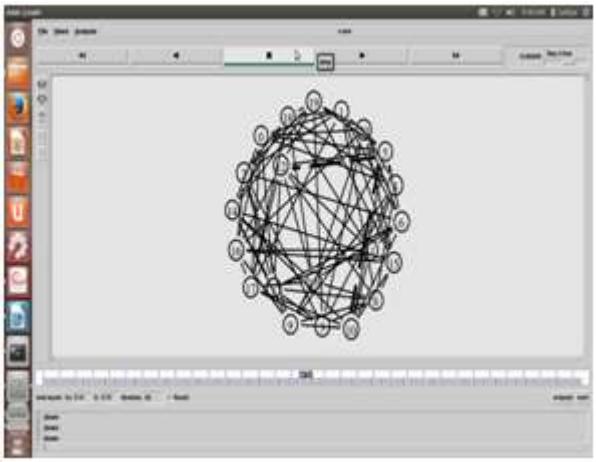
4. For node 13 two hops commutation occur between 2-1-0 ,source node is 2 and destination node is 0.



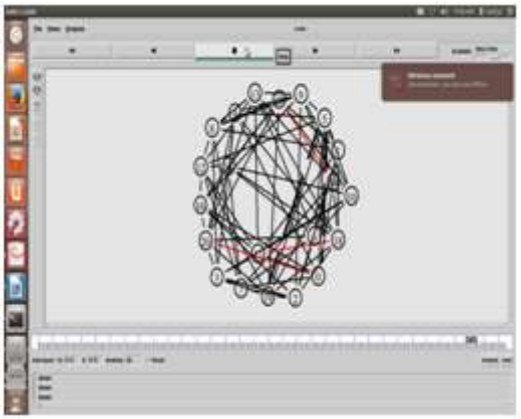
5.For node 13, link failure occur between node 1 and node 2 now packets are moving from 2-3-0.



6. For node 21 communication occur in two hops 12-5-10 here node 12 as source node and node 10 act as a destination node .



7.For node 21, link failure occur and communication occur in two hops .



5.Result Analysis

We had implemented perfect difference network for the value of n=7,13,21 .

Nodes	7 ,13 ,21
Topologies	PDN
Traffic Rate	CBR
Network Protocol	UDP
Network Parameter	Latency
Bandwidth	1MBPS
Packet size	500 bytes
Routing Protocol	Distance vector
Source Node	Node 1,2
Destination Node	Node 3,0
Routing Strategic	Dynamic

5.1 Latency result for 7 nodes

Path1	1-0-3	0.01 second
Path 2	1-4-3	0.01 second
Path 3	1-5-6-3	0.03 second

5.2 Latency result for node 13

Path 1	2-1-0	0.01 second
path 2	2-3-0	0.01 second

5.3 Latency result for 21 nodes

Path1	12-5-10	0.01 second
Path2	0-5-19	0.01 second

6.Conclusion

The Perfect Difference Network n=7,13,21 based on PDS {0,1,3} and{0,1,3,9},{0,1,4,14,16} is analyzed and simulated. For simulation of network has used NS2 as it is an open source discrete event simulator and it again provides one to one correspondence between a class in compiled hierarchy and the one in interpreted hierarchy. This paper has tested the network for protocols UDP. Again showed details study of the network parameters like Latency for the same Perfect Difference Network for the value of δ=2,3,4. Latency is found to be same for the value of δ=2,3,4. The simulated results shows that communication occur at most in two hops for different value of δ=2,3 ,4. The advantage of PDN has low cost compare to the N Complete Network. Cost of PDN is less by reducing links.

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