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RESEARCH PAPER

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Effects of Back off factor and retry limit on Performance of Exponential Back off Algorithm

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Abstract: Binary Exponential Back off Algorithm are widely used as a Network Congestion Avoidance or collision resolution protocol. In this paper we analyze the effect of Back off factor on exponential algorithm with predefined retry limit (retransmission limit would be bounded) .The analysis has been taken in saturation throughput and medium access delay of a packet for a given number of node N. Binary exponential algorithm is a special case of exponential Back off algorithm when r=2, where r is a back off factor. In this paper we analyze the effect of Back off factor r=1.2, 1.5, 1.7, 1.8, 1.9, 2.0 & all simulation result are obtained through Matlab (Matrix Laboratory) simulation Language.

Keyword: Binary Back off algorithm, Medium access delay, performance analysis, throughput.

I. INTRODUCTION

Exponential backoff algorithm is widely used collision resolution protocol. r is used as a backoff factor in exponential backoff Algorithm. When r=2, then it is called binary exponential backoff algorithm (particular case of exponential backoff algorithm) [1].

In EB (Exponential Backoff Algorithm) with maximum retry limit M, a packet is dropped after M transmission retries [1]. In BEB, after i consecutive packet transmission failure a node selects a single random slot from next 2^i slots (contention window) with equal probability for the next transmission.

II. PROBLEM STATEMENT

Assume that a node is trying to send a packet to another node and the destination node is not reachable due to some problem. Then the source node will continue to retransmit the packet, and other packets in the queue destined to other reachable nodes will not be able to get through even when channel is idle [5][4]. In this paper we analyze the effect of Backoff factor on various parameters.

III. EFFECT OF BACKOFF FACTOR ON EXPONENTIAL BACKOFF ALGORITHM

Assume that a node is trying to send a packet to another node and the destination node is not reachable due to some problem. Then the source node will continue to retransmit the packet, and other packets in the queue destined to other reachable nodes will not be able to get through even when channel is idle. Furthermore without transmission retry limit, the packet transmission delay can grow beyond reasonable range [6]. The contention window W_i is given as.

$$W_i = \begin{cases} r^i wo & i = 0,1,\ldots..,m \\ r^m wo & i = m, m+1,\ldots..M \end{cases} \quad (1)$$

Where the W_i is the contention window size. Let us assume that the probability of collision is p_c and the probability of transmission is p_t. As the number of nodes increases, p_c approaches to unity and due to collision [2][3]. After M retry Limits the packets will be dropped.

IV. ABBREVIATION USED

r : Backoff Factor
N: Number of Nodes
M: Maximum retry Limit
Wo : Contention window Size
Pc : Probability of collision)
Pt: Probability of Transmission

V. RELATION BETWEEN N (NUMBER OF NODES), W_O (CONTENTION WINDOW SIZE) & P_C (PROBABILITY OF COLLISION) WHEN R=2 & M=7

N	Pc when Wo=4, M=7	Pc when Wo=8	Pc when Wo=16	Pc when Wo=32	Pc when Wo=64	Pc when Wo=128
2	.272	.178	.104	.057	.03	.015
3	.368	.271	.178	.105	.057	.030
4	.421	.328	.231	.144	.082	.044
5	.458	.367	.271	.178	.104	.057
6	.487	.397	.303	.206	.125	.069
7	.51	.421	.328	.231	.144	.081
8	.529	.441	.349	.252	.161	.093
9	.540	.458	.367	.271	.178	.105

10	.561	.473	.383	.288	.193	.115
11	.575	.487	.397	.303	.206	.125
12	.587	.499	.410	.316	.219	.135
13	.599	.510	.421	.328	.231	.144
14	.610	.520	.432	.339	.242	.153
15	.621	.529	.441	.349	.252	.162
16	.631	.538	.450	.359	.262	.170
17	.640	.546	.458	.367	.271	.178
18	.650	.555	.466	.376	.280	.185
19	.660	.562	.473	.383	.288	.193
20	.669	.570	.480	.390	.295	.199
21	.679	.576	.487	.397	.302	.206
22	.689	.583	.493	.404	.309	.213
23	.700	.589	.499	.410	.316	.219
24	.713	.596	.505	.416	.322	.225
25	.735	.602	.510	.421	.328	.231
26	>1	.607	.515	.427	.334	.237
27	>1	.613	.520	.432	.340	.242
28	>1	.619	.529	.437	.344	.247
29	>1	.625	.530	.441	.350	.252
30	>1	.631	.535	.446	.354	.257

VI. RELATION BETWEEN N (NUMBER OF NODES), W_O (CONTENTION WINDOW SIZE) & P_C (PROBABILITY OF COLLISION) WHEN R=2 & M=6

N	Pc when wo=4	Pc when wo=8	Pc when wo=16	Pc when wo=32	Pc when wo=64	Pc when wo=128
2	.273	.178	.104	.057	.029	.015
7	.529	.430	.330	.231	.144	.081
12	.618	.517	.418	.318	.219	.135
17	.675	.571	.471	.372	.272	.177
22	.717	.611	.510	.411	.311	.213
27	.751	.643	.541	.441	.342	.242
32	.779	.670	.566	.466	.367	.267
37	.803	.693	.588	.488	.389	.289
42	.824	.713	.607	.506	.407	.307
47	.843	.732	.624	.523	.424	.324
52	.860	.748	.640	.538	.439	.339
57	.875	.763	.654	.551	.452	.353
62	.889	.776	.667	.564	.464	.365
67	.901	.789	.679	.575	.475	.376
72	.913	.801	.691	.586	.486	.387
77	.924	.812	.701	.596	.495	.397
82	.934	.823	.711	.605	.505	.406
87	.944	.832	.721	.614	.513	.414
92	.953	.842	.730	.623	.521	.422
97	.962	.850	.738	.631	.529	.430
102	.969	.858	.746	.638	.536	.437
107	.976	.866	.754	.646	.543	.444
112	.984	.874	.761	.653	.550	.451
117	.990	.881	.768	.659	.556	.457
122	.997	.887	.775	.666	.562	.463

VII. RESULT

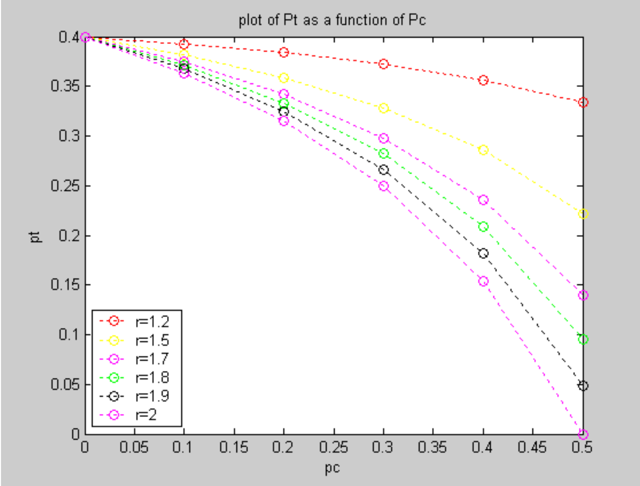

Figure: 1 Plat of Pt as a function of Pc

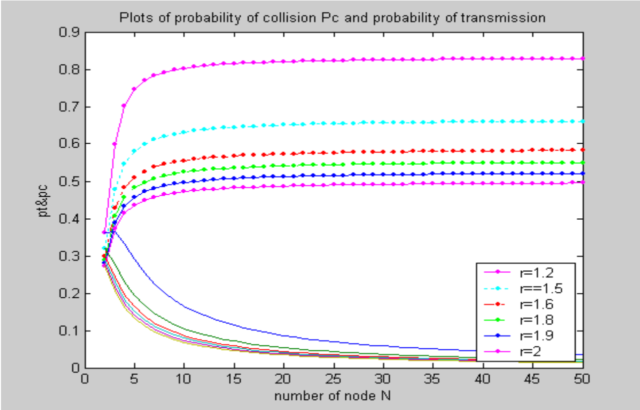

Figure: 2 Effect of Pt and Pc when no, of n modes increases

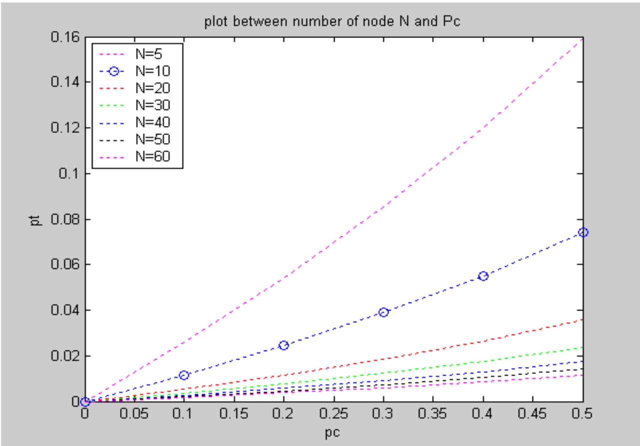

Figure: 3 Relation between $P_c$and P_t

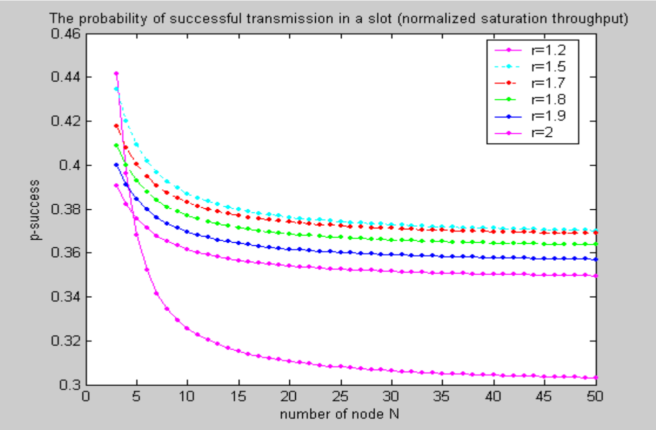

Figure: 4 Plot between probability of success and no. of nodes, N

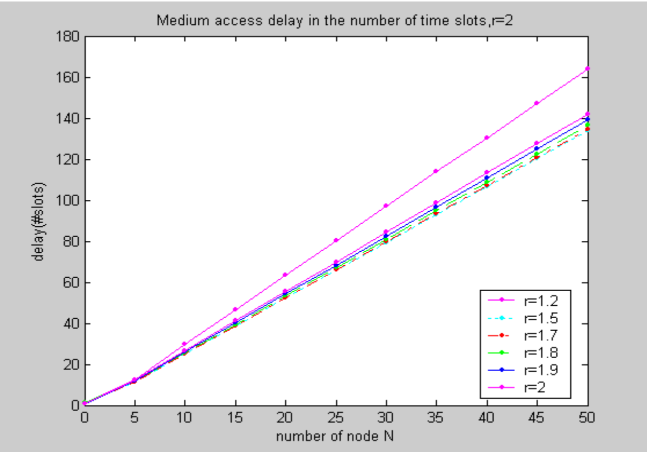

Figure: 5 Plot between delay (# Slots) nad n. of Nodes

VIII. CONCLUSION

We analyze the medium access delay with different values of backoff factor. The results indicate the BEB-M also bounds the medium access delay. These benefits are accomplished by limiting the number of transmission retries for a packet and thus giving a chance of transmission to the next packet waiting. Effect on p_c and p_t is also demonstrated by the result. As established, when the number of nodes increases the probability of success decreases.

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