International Journal on Emerging Technologies **4**(2): 56-60(2013)

ISSN No. (Print) : 0975-8364
ISSN No. (Online) : 2249-3255

A Comparative Study of Election Administration Approach with Bully and Modified Versions of Bully Algorithm in Normal Case of Election

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(Received 15 July, 2013 Accepted 17 August, 2013)

ABSTRACT: The comparative analysis of bully and other modify election algorithm with our proposed algorithm election administration would be appropriate to determine which algorithm performs better than the others. This paper represents the different case in which we compare and discuss our approach with original bully algorithm and existing modified versions of bully algorithm in normal case of election.

Keywords*:* Performance, failure, lowest priority, best case, detects, coordinator, worst case.

I. INTRODUCTION

If there are n processes in the system and p is the process number which detects failure of coordinator, then: In original bully algorithm and all other modify algorithms there will be needed of message passing between processes. In order to compare the performance of the algorithms, we execute them in three test cases where the systems comprised 5, 10, and 20 nodes/process respectively. In this paper section 2 represents the overview of comparison in normal case, section 3 we presents the comparative study of different approach in worst case, section 4 presents the a comparative study of differrent approach in best case. Finally section 5 concludes the paper.

II. COMPARISON IN NORMAL CASE (NC)

CASE CAUSE: Normally failure of the coordinator.
The following Fig. 1 showed the normal case in which we compare and discuss our approach with original bully algorithm and existing modified versions of bully algorithm.

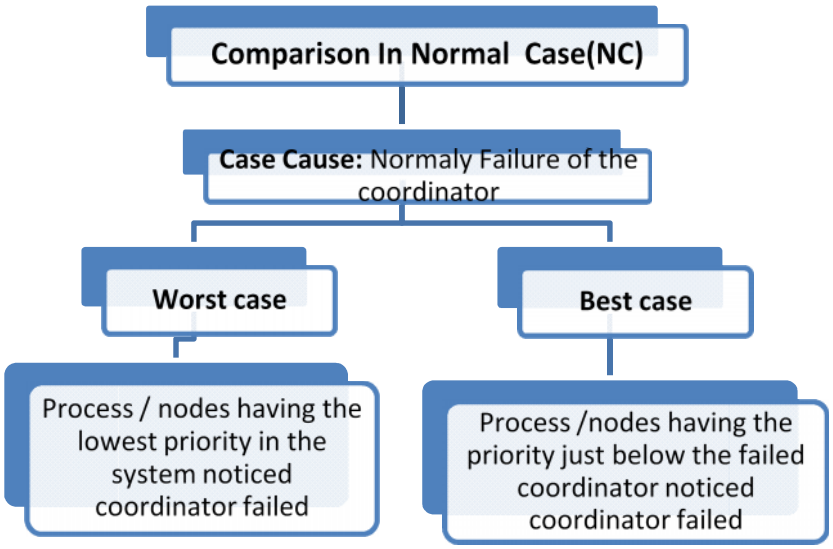

Fig. 1. Comparison in Normal Case (NC).

III. WORST CASE

The process / nodes having the lowest priority in the system noticed that the coordinator has just crashed. In the above case when a process with the lowest process number detects coordinator as failed, then it requires message passing. Garcia-Molina's bully algorithm requires $O(N^2)$ messages to elect a coordinator node [1]. The modified Bully Algorithm proposed in Mamun, Q. K. gains a significant improvement in the worst case. It requires only O(n) messages to elect a new coordinator node in the worst case [2]. The algorithm proposed by Md. Golam Murshed and Alastair R. Allen also requires at most 2N – 1 messages in the worst case if at least one node in Candidate is live [3]. In worst case that is the process with lowest process number detects coordinator as failed our new developed approach requires only 1+2+n-1 messages passing [4]. The table 1, 2 and 3 shown the comparative NC performance analysis of our approach with bully and different modifies bully algorithms.

Table 1. NC Performance analysis: Number of Node / Process = 5.

Case	Algorithms	Number of Node / Process = 5		
		Node Failed	Detector Node	No. of Messages
Worst	Bully	P5	P1	20
Worst	Mamun, Q. K.	P5	P1	11
Worst	Golam and Alastair	P5	P1	9
Worst	Election Administration	P5	P1	7

Table 2. NC Performance analysis: Number of Node / Process = 10.

Case	Algorithms	Number of Node / Process = 10		
		Node Failed	Detector Node	No. of Messages
Worst	Bully	P10	P1	20
Worst	Mamun, Q. K.	P10	P1	11
Worst	Golam and Alastair	P10	P1	9
Worst	Election Administration	P10	P1	7

Table 3. NC Performance analysis: Number of Node / Process = 20.

Case	Algorithms	Number of Node / Process = 20		
		Node Failed	Detector Node	No. of Messages
Worst	Bully	P20	P1	380
Worst	Mamun, Q. K.	P20	P1	56
Worst	Golam and Alastair	P20	P1	38
Worst	Election Administration	P20	P1	22

Here in the example of tables 1, 2 and 3 node/process 1 detects that the current coordinator nodes node P5, P10 and P20 has crashed. The traditional Bully algorithm elects a new coordinator node in this case by performing a series of redundant elections and ends up when nodes are P5, P10 and P20. It producing 20, 90 and 380 messages in total. Mamun, Q. K. Algorithm needs 11, 26, 56 messages to elect a new coordinator. Md. Golam Murshed and Alastair R. Allen algorithm needs 9, 18, 38 messages to elect a new coordinator. Our proposed algorithm needs 7, 12 and 22 fewer messages. The following Fig. 2 shown the comparative performance analysis of our approach with bully and different modifies bully algorithms in worst case.

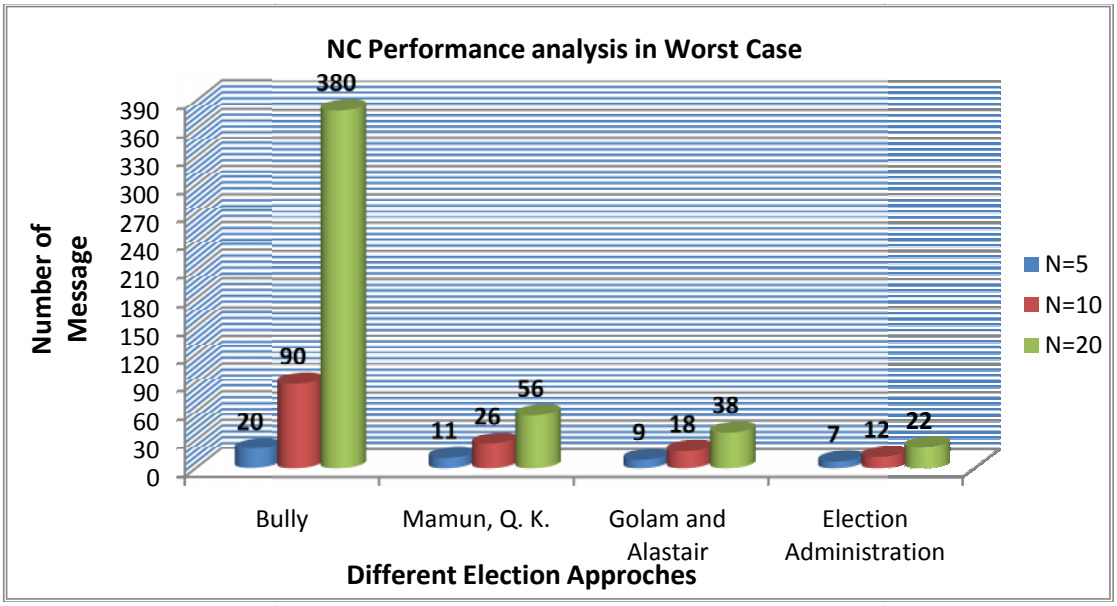

Fig. 2. NC Performance analysis in Worst Case.

IV. BEST CASE

In this case the process /nodes having the priority just below the failed coordinator, detects that the coordinator has failed.

In best case of election Garcia-Molina's bully algorithm requires N − 1 messages to elect a coordinator node in the best case, where N is the number of nodes. It will send election messages to N −1 nodes having higher id than itself. Each of the nodes eventually initiates a separate election one by one. Hence, it requires N − 1 messages in the best case [1]. The modified Bully Algorithm proposed in Mamun, Q. K. also requires N − 1 messages in the best case [2]. The algorithm proposed by Md. Golam Murshed and Alastair R. Allen also requires N − 1 messages in the best case [3]. For the best case of our proposed algorithm there will be need of 1 election message to inform EA, 1 verify message to ensure the failure of coordinator, and n-1 messages to inform about new coordinator. In that case, our algorithm requires only 1+1+ n-1 messages [4].

Here in the example of Table 4 node/process P4 first detects that the current coordinator node/process P5 has crashed and declares itself as the new coordinator. The number of messages for this case is 4 the same for all three algorithms. In our approach it requires two extra messages one inform the EA and second is verified message by EA. It required 6 messages to elect new approach.

Table 4. NC Performance analysis: Number of Node / Process = 5.

Case	Algorithms	Number of Node / Process = 5		
		Failure Node	Detector Node	No. of Messages
Best	Bully	P5	P4	4
Best	Mamun, Q. K.	P5	P4	4
Best	Golam and Alastair	P5	P4	4
Best	Election Administration	P5	P4	6

In Table 5 and Table 6, node P9 and P19 first detects that the current coordinator node, node P10 and P20 has crashed and declares itself as the new coordinator. The number of messages for this case is 9 and 19 the same for all three algorithms. In our approach it require on extra message that inform the election administration. It sends 11 and 21 coordinator messages. The following Fig. 3 shown the comparative performance analysis of our approach with bully and different modifies bully algorithms in best case.

Table 5. NC Performance analysis: No. of Node / Process = 10.

Case	Algorithms	Number of Node / Process = 10		
		Failure Node	Detector Node	No. of Messages
Best	Bully	P10	P9	9
Best	Mamun, Q. K.	P10	P9	9
Best	Golam and Alastair	P10	P9	9
Best	Election Administration	P10	P9	11

Table 6. NC Performance analysis: No. of Node / Process = 20.

Case	Algorithms	Number of Node / Process = 20		
		Failure Node	Detector Node	No. of Messages
Best	Bully	P20	P19	19
Best	Mamun, Q. K.	P20	P19	19
Best	Golam and Alastair	P20	P19	19
Best	Election Administration	P20	P19	21

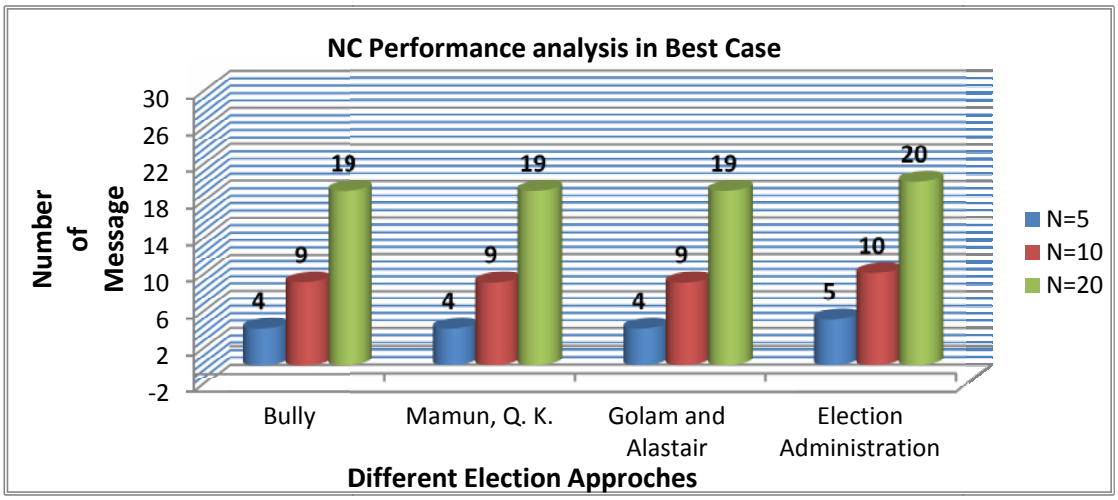

Fig. 3. NC Performance analysis in Best Case.

V. CONCLUSION

In worst case our algorithm is fast and guarantees correctness and robustness, and the results show that it requires fewer messages to elect a new coordinator. In this case our new approach needs two extra messages to elect the coordinator: Election Message to inform the EA and verify message by EA to current coordinator but remove the problem of redundant election.

In original bully algorithm and modified bully algorithm if coordinator is running unusually slowly say system is not working properly for some reasons or the link between a process and coordinator is broken for some reasons there will be redundant election, although current coordinator is up.

But in our algorithm, as EA verifies either current coordinator is really up or down when EA receives any election message from any process, it ensures that there will be no redundant election in the system. So we can say that our approach is much better compare to all the existing election approaches.

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