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Study of Assorted Election Algorithms in Distributed Operating System

[1]Deepika Garg ,[2]Suman , [3]Neha
[1,2,3]M.Tech scholar, [2]Associate Professor
[1,2,3]T.I.T&S College, Bhiwani,Haryana
[1]deepugarg22@gmail.com

Abstract— In Distributed System surroundings like human life surroundings we want a manager to coordinate the duty of all the processes. We entitle this method as a frontrunner. Leader Election is that the method of designating one method because the organizer of some task distributed among many nodes. Goal of the election rule is to confirm that once an election starts,it concludes with all the processes agreeing on who subsequent arranger is to be.

Index Terms— **Communication, System ,Bully ,Coordinator, Algorithm, Processes , Node ,Distributed System , Priority ,Ring.**

I. INTRODUCTION

A Distributed system is an application that executes a collection of protocols to coordinate the actions of multiple processes on a network, such that all components cooperate together to perform a single or small set of related tasks. It is difficult for processes to cooperate with each other because failures of any of the process during communication .In distributed system a single process is choose to control or coordinate the operation of the entire system. So the entire system will run smoothly. To decide which process takes this responsibility, there are several algorithms available that give the idea, which process works as coordinator in the system.

In this paper we first present the concept of election algorithm in bully and ring election algorithms and their disadvantages. In Bully Election Algorithm every process has a unique priority number. Any process which discovers the crash of coordinator sends an election message to all higher priority processes. On receiving the election message, replying OK to the sender and sending an election message to all higher priority processes. The process that does not receive OK becomes the new coordinator. This algorithm can work even in case that processes crash during the election.In Ring Election Algorithm every process has a unique priority number, forming a logical ring, and everyone knows who is his successor.

Any process which discovers the crash of coordinator sends an election message to its successor. When the message circulate back to the initiator he gets the whole process list. Then he knows who is the new coordinator now. A Coordinator message is send to travel to notify everyone about the new coordinator. After Bully algorithm an optimized method for the bully algorithm called Modified Bully algorithm is used which is time bounded. Improved Bully algorithm selects the coordinator before current coordinator is crashed. We compare and evaluate the algorithms based on their message passing complexity.

II.ELECTION ALGORITHMS

The election algorithm is an algorithm for choosing a coordinator or leader in the entire system from all the currently available running processes. Since all other processes in the system have to interact with the coordinator , they all must agree on who the coordinator is. Furthermore, if the coordinator process fails due to any reason e.g. Hardware fail, link fail, etc. A new coordinator process must be elected to take up the job of the failed coordinator. An election algorithm is used for solving the all above problems.

II. EXISTING ALGORITHMS

Many distributed election algorithms have been proposed to resolve the problem of leader election. Among all the existing algorithms, the most prominent algorithms are as

A. Bully Algorithm presented by Gracia-Molina in 1982.
B. Modified Bully Election Algorithm in Distributed Systems presented by M.S.Korda fshari and group
C. Improved Bully Election Algorithm in Distributed System presented by A.Arghavani in 2011
D. Ring Election Algorithm In distributed Operating Systems

A)Bully Algorithm

Bully Algorithm is one of the most promising election algorithms which were presented by Gracia Molina in 1982.The algorithm take the following assumption.

Assumptions

- Each process has a unique number to distinguish them.
- Each process knows the process number of all other process.
- In the election, a process with the highest process number is elected as a coordinator.
- A failed process can rejoin in the system after recovery.
- The model is timely bounded.

Algorithm

The algorithm portray the subsequent steps:

- When a process P detects that the coordinator is not responding on time, it initiates an election and send election message to all processes with higher number.
- If no one other processes respond within time , P wins the election and becomes coordinator.
- When a process receives an election message from any lowered number process.
- The receiver process sends ok back to the sender process.
- Now the receiver holds an election, unless it is already holding one.
- And now this process sends the election message to higher number process than itself.

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- All the process gives up except one that is the new coordinator.
- New coordinator announces itself as a coordinator by sending leader message to all other process in the entire system.
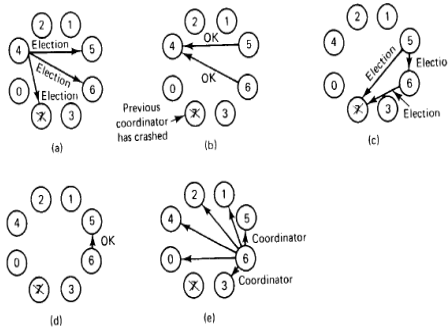
Bully Algorithm Example

Fig.1 Working of Bully Algorithm

- The group consists of 8 processes.
- Previously process 7 was the coordinator, but it has just crashed.
- Process 4 is the first one to notice this, so it sends ELECTION messages to all the processes higher than it, namely Processes 5 and 6 both respond with OK.
- Upon getting the first of these responses, 4 knows that its job is over.
- Both 5 and 6 grasp elections, each one only sending message to those processes higher than itself.
- Process 6 tells 5 that it will take over.
- 6 knows that 7 is dead and that it is the winner. 6 announces this by sending a COORDINATOR message to all running processes.
- When 4 gets this message, it can now continue with the operation it was trying to do when it discovered that 7 was dead, but using 6 as the coordinator this time.
- If process 7 is ever restarted, it will just send all the others a COORDINATOR message and bully them into submission

Disadvantages

Bully algorithm has subsequent disadvantages:

- It required that every process should know the identity of every other process in the system so it takes very large space in the system.
- It has high number of message passing during communication which increases heavy traffic .the message passing has order o (n^2).

C) Modified bully Election Algorithm in Distributed System

Modified bully Election algorithmic rule is given by M.S. Kordafshari ,M.gholipour, M.jahanshahi ,A.T.haghighat in 2005.The algorithmic rule resolve the disadvantages of the bully algorithmic rule. The changed bully algorithmic rule takes the subsequent assumptions.

Assumptions

This algorithm assumes the alike system model as in previously defined bully algorithm. But follow the different procedure.

Algorithm

- When any process p notices that coordinator is not responding, it initiates an election and send election message to all process with higher priority number.
- If no process responds, process P wins the election and becomes new coordinator.
- Process with the higher priority sends ok message with its priority number to process P.
- When process p receive all the response it select the new coordinator with the highest priority number process and sends the grant message to it.
- Now the coordinator process will broadcast a New coordinator message to all other process and informs itself as a coordinator.

Disadvantages

- A modified algorithm is as well time bounded.
- It is better than bully but also has o (n^2) complexity in worst case.
- It is necessary for all process to know the priority of other.

Improved Bully Election Algorithm in Distributed Systems

This algorithm is presented by A.arghavani, E.ahmadi, A.T.haghighat in 2011. It also overcomes the disadvantages of the original bully. The main concept of this algorithm is that the algorithm declares the new coordinator before actual or current coordinator is crashed. This algorithm also makes some assumption.

Assumptions

- Each process has a unique number to discriminate them.
- Each process knows the process number of all other process.
- When any novel process enters in the running system. It sends its id to coordinator and coordinator update the list of available process and send in the network.
- There is no time bound during communication.

Algorithm

This algorithm selects the coordinator earlier than current coordinator is crashed. So it takes extra stages. In this algorithm before the coordinator is failed, the current coordinator tries to gather information about processes in the system and through the current coordinator, declares the next possible coordinator to the processes. With increasing knowledge and get the id of all other process, a process with the bigger id attempts to execute the bully algorithm.

If the coordinator is botched each process that notices this failure compares its id with the id which it has received via the coordinator. And select the new coordinator

Disadvantages

- It has complex structure.
- Every time process updates its database.

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- Large database required to maintain the information of each process in database of every process.

C)Ring Election Algorithm In Distributed System

- Based on the use of a ring.
- Presume: the processes are physically or logically ordered, so that each process knows who its successor is.
- When any process notices that the coordinator is not functioning, it builds an ELECTION message containing its own process number and sends the message to its successor.
- If the successor is down, the sender skips over the successor and goes to the next member along the ring, or the one after that, until a running process is located.
- At each step, the sender adds its own process number to the list in the message.
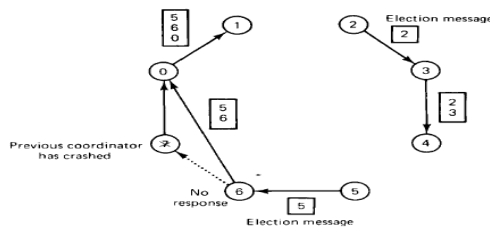

Fig.2 Working of Ring Algorithm

- Eventually, the message gets back to the process that started it all.
- That process recognizes this event when it receives an incoming message containing its own process number.
- At that point, the message type is changed to COORDINATOR and circulated once again, this time to inform everyone else who the coordinator is (the list member with the highest number) and who the members of the new ring are.
- When this message has circulated once, everyone goes back to work.
- Two processes, 2 and 5, discover simultaneously that the previous coordinator, process 7, has crashed.
- Each of these builds an ELECTION message and starts circulating it.
- Eventually, both messages will go all the way around, and both 2 and 5 will convert them into COORDINATOR messages, with exactly the same members and in the same order.
- When both have gone around again, both will be removed.
- It does no harm to have extra messages circulating –at most it wastes a little bandwidth.

IV.CONCLUSION

There are numerous election algorithms available in Distributed system. In this paper we discuss the concept of some existing algorithms .Some disadvantages of existing algorithms are considered based on the analysis. Assume n processes are there and one election is in progress. Bully algorithm in worst case requires $O(n^2)$ messages and in best case requires n-2 messages. In Ring algorithm always 2(n-1) messages are required.

V.FUTURE WORK

In future we implement this algorithm on different networks and analyze the result of different networks. Based on their efficiency we can work with these algorithms.We can overcome the disadvantages of previously used algorithms with the help of modified algorithms.

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