A Trusted Node Based Checkpointing Scheme for Mobile Ad-hoc Networks by Flower pollination algorithm

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Abstract- MANET is used in various fields for the effective communication process in which user send their information from one node to another node. Sometimes user sends the secret information data on the wireless network, it is very important to send this information very safely. MANET do not use any hardware for storage, for that use check point but which nodes will be a check point, it is a decision problem which is selected in this paper by using flower pollination algorithm. Flower pollination optimization algorithm (FPOA) is an optimization algorithm which is based on the biological behavior of pollination in the flowers. The reproduction in plants is done by pollination process. The pollination is performed by the agents called pollinators in local and global flow. In this experiment, we compared checkpoint cost in form of time and number of check point and FPAM show effective less cost and then compare with the existing methods to check its effectiveness.

Keyword: Checkpoint, FPA, cost, MANET

I. INTRODUCTION

Mobile ad-hoc network is combination of mobile devices which communicate with each other without any predefine infrastructure or any centralized administration. MANET supports the dynamic structure of network. MANET applications are mainly used in disaster relief, vehicle network, military, and robot networks and so on. MANET is used in various fields for the effective communication process in which user send their information from one node to another node. . Sometimes user sends the secret information data on the wireless network, it is very important to send this information very safely. In this network sensor nodes used wireless communication and it is easy to eavesdrop. To overcome this issue some protocols are used called as checkpointing protocols. The proactive protocols send their request to their neighboring nodes to draw network topology at that that time a routing table is generated by them. In reactive protocols the have already stored the information and they only approach for the routing information because they do not have any specific known route. When the last goal is achieved it forwards the answer to the source. After this source transmit the information on the new route. The hybrid protocol in mobile ad-hoc network provides the features of proactive and reactive routing [1]. The capacity of reacting to unknown software of hardware resources is called as fault tolerance. Check point provides the stable storage of the data where it is possible to rollback the data. This feature enhances the quality of fault tolerance.

The checkpointing algorithms are mainly based on the rollback process and it is divided into two types:

a) Coordinated checkpointing

b) Uncoordinated checkpointing

Coordinating checkpointing is used to prevent the data computation from loss and failure. The check point of a process is when a system stores the data periodically and it is used when the recovery process is started. The data is recovered from the last checkpoint. This process provides the stable storage. This type is divided into two types that are following:

i) Blocking: All other process are blocked when checkpoint are taken to increase the execution time.

ii) Non- Blocking: In this process processes are not blocked when checkpoint is being taken.

In Uncoordinated checkpointing process permits each procedure to choose the checkpoint. In this process, each process does not have the learning or other process but rather it takes checkpoint freely.

The check pointing design for MANET is quite challenging and got some attention in literature reviewed. For implementation clusters which depend on distance and energy minimization, we proposed flower pollination algorithm.

We now present the idea of "centrality". In the networks setting, it is regularly central to figure out which hubs and edges are more basic than others. Exemplary illustrations

incorporate distinguishing the most important expressways in a road network, the most compelling individuals in an informal community or the most basic useful elements in a network. Thus, the idea of centrality, which plans to measure the importance of individual nodes in a network and check pointing decision, has been widely examined in network examination. In this manner, the quantity of check focuses and cost of checkpoints are assessed.

II. LITERATURE REVIEW

Checkpointing process provides the fault tolerance to the wired as well as wireless network and also to the mobile networks. This process is not able to direct support the MANET due to is dynamic nature and unavailability of fixed architecture. The checkpointing distributed application is proposed to provide the fault tolerance in the cluster based mobile ad-hoc network. This approach is economically effective in the wireless network with less message cost [1]. The task processing time on the cloud environment is minimizes by the optimal numbers of the checkpoints. This is done by using stochastic model of parallel processing and it derives the explicit expression. The result of the proposed approach provides sufficient accuracy in the cloud environment [2].

The trust-based secure checkpointing approach is proposed in this work to provide the security with the help of cryptography approach. This approach reduces the overhead and consumption of resources. In this work mobile host is examined if it is trusted then encryption process is not required and it is applicable only in some cases [3]. An ant colony optimization based model is proposed which calculates the trust value of the mobile node in the network. The trusted node will never send the malicious data and it has low failure rate with high security. The checkpoint approach in trusted mobile node is secure and does not have any additional overhead of cryptography. This approach provides the maximum recovery probability [4].

The trust-value based approach is proposed which capture the node after verifying its movements from one cluster to another cluster. Each cluster has many numbers of nodes with different trust value and move from one cluster to another with different value. The threshold values of the nodes are not fixed to take a checkpoint. When a node changes its cluster from one to another its cluster_change_count is compared with threshold value. In this work three different phases are involved that are checkpointing, trust node evaluation and recovery phase [5]. The coordinating checkpointing algorithm is proposed with non-blocking modes which provide the fault tolerance in cluster based MANET. In this approach a small amount of host are taken checkpoints. This approach performs well when compared to the existing nodes [6]. The trusted node approach provides a new feature of preserving system consistency when failure occurs in the network. Basically, it is a distributed method which provides the fault tolerance. It provides the recovery at low message overhead [7].

III. FLOWER POLLINATION ALGORITHM

Flower pollination optimization algorithm (FPOA) is an optimization algorithm which is based on the biological behavior of pollination in the flowers. The reproduction in plants is done by pollination process. The pollination is performed by the agents called pollinators in local and global flow. On the basis of transfer mechanism pollination process is divided into two types that are biotic and a biotic.

In biotic pollination, insects and animals are the agents to transfer the pollens and in abiotic process flower do not need any pollinator agent. Generally, the flowers performed the pollination in biotic form. This fact clearly show that the flowers depends on the pollinators for the pollination process and pollinator agents travels a lot for global pollination. This pollinator agent follows the concept of L'evy's flight behavior.

For each flower there is different pollinator and it is responsible for pollination this process represents the flower consistency. The cost of investigation is reduced by using the concept of flower consistency. In evolutionary process it increases the transferring time of pollens and then optimize and maximize the reproduction process.

With the constrained accessible memory of pollinators, flower consistency wipes out the learning, examination and exchanging. Moreover, it can be considered as an incremental advance in light of the likeness/contrast of any two blossoms. The organic goal of the flower pollination is to ideally recreate other gigantic ages of the flower kind with the fittest highlights that guarantee the kind`s survival. So as to in a perfect world formalize the blossom fertilization calculation, qualities of fertilization process, flower steadiness and pollinator conduct ought to be approximated in view of the accompanying basic standards:

i. Global pollination is achieved by L'evy's flights` travelling pollinators for both biotic and cross-pollination.

ii. Local pollination in flowers is achieved by abiotic and self-pollination.

iii. The new generation reproduction probability depends on the flower consistency and proportional to flowers` similarities/differences.
iv. The switch probability $p_S \in [0, 1]$ controls the shift between local and global pollination.

In flower pollination algorithm it is supposed that each plant has only one flower and they produce one pollen gamete. Thus there is no need to distinguish a pollen gamete, a flower, a plant or solution to a problem.

Algorithm: FPA Module

Step 1: Min or max Objective F(u), where u=(u_1,u_2,……..u_d).
Step 2: Initialize m pollen gametes or flower population having random solutions.
Step 3: The best solution S_* is found in the initial population.
Step 4: A switch probability is defined as $p_S \in [0, 1]$.
Step 4.1: In case T<MaxGen, for i=1:m
A step vector l (obeys Levy distribution) is drawn as $p_S > rand$, the global pollination

$$u_x^{1+1} = \gamma l(S_* - u_x^t) + u$$

Where,
γ is the scaling factor for step size control,
u_x^t is the solution vector at t iteration,
x, y and n are the pollens
Step 4.2 : Otherwise, drawing ϵ with uniform distribution [0,1]
So, local pollination $u_x^{1+t} = \epsilon(u_y^t - u_n^t)$
Step 5: New solution is evaluated as the solution obtained are better and updating the population.
Step 6: Best current solution is found.

IV. SYSTEM MODEL DESCRIPTION

Step1: Deploy the Manet Node and make random cluster base on distance
Step2: Initialize the flower pollination algorithm with objective function minimizing energy
Step3: After making cluster calculate the trust value and make check point
Step4: Calculate trust value by Network analysis by game theory
Step5: Trust value indicates or predict how much possibility node disconnection
Step6: Evaluate the cost, and number of check points

V. EXPERIMENTAL RESULTS

Check pt.	Proposed Cost (ms)	Without Optimization (ms)	Existing Cost (ms)
1	1.19	4.402	2
2	43.12	75.8402	73.1843
4	108.36	171	178.633
6	209.92	329	309.2177
8	413.15	557	542.0996
10	774.176	957.631	933.6266

Table 1: Performance comparison table

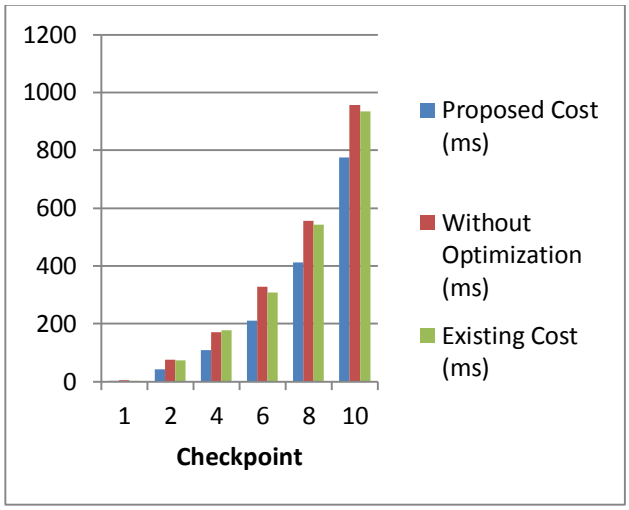

Figure 1: Performance comparison graph

VI. CONCLUSION

In this paper a new trusted node based checkpointing algorithm is proposed to provide the effective fault tolerance and data optimization. This algorithm is based on the flower pollination algorithm in which the optimization is based on the behavior of L'evy method. The flying steps of the L'evy method are called as flight distribution. The result of the proposed FPA approach is compared with existing approach and it gives effective result at low cost shown in the figure 1 by blue colored bar on it.

VII. REFERENCES

[1] Mansouri, Houssem, et al. "Checkpointing distributed application running on mobile ad hoc networks." *International Journal of High Performance Computing and Networking* 11.2 (2018): 95-107.
[2] Hirai, Tsuguhito, et al. "Performance optimization of parallel-distributed processing with checkpointing for cloud environment." *Journal of Industrial & Management Optimization* (2018): 314-347.
[3] Biswas, Suparna, Priyanka Dey, and Sarmistha Neogy. "Secure checkpointing-recovery using trusted nodes in MANET." *Computer and Communication Technology (ICCCT), 2013 4th International Conference on*. IEEE, 2013.
[4] Biswas, Suparna, Priyanka Dey, and Sarmistha Neogy. "Trusted checkpointing based on ant colony optimization in

MANET." *Emerging Applications of Information Technology (EAIT), 2012 Third International Conference on*. IEEE, 2012.
[5] Saini, Poonam, and Shefali Aggarwal. "A Trust-based Uncoordinated Checkpointing Algorithm in Mobile Ad Hoc Networks (MANETs)." *Procedia Computer Science* 70 (2015): 311-317.
[6] Mansouri, Houssem, et al. "Adaptive fault tolerant checkpointing algorithm for cluster based mobile ad hoc networks." *Procedia Computer Science* 73 (2015): 40-47.
R. Tuli & P. Kumar, "Minimum Process Coordinated Checkpointing Scheme for Ad-Hoc Networks", International Journal on AdHoc Networking Systems (IJANS), Vol. 1, No. 2 , pp. 51-63, October 2011.
[7] S. Biswas, S. Neogy and P. Dey, "Mobility based Check pointing and trust based recovery in MANET", International Journal of Wireless & Mobile Networks (IJWMN), Vol. 4, No. 4, pp. 53-69, August 2012.
[8] Khamrui, Pulak, and Koushik Majumder. "A trusted node based checkpointing scheme for mobile ad-hoc networks (MANETs)." *Electronics and Communication Systems (ICECS), 2015 2nd International Conference on*. IEEE, 2015.
[9] Aadithya, Karthik V., et al. "Efficient computation of the shapley value for centrality in networks." *International Workshop on Internet and Network Economics*. Springer, Berlin, Heidelberg, 2010.
[10] Awasthi, Lalit Kumar, and Prashant Kumar. "A synchronous checkpointing protocol for mobile distributed systems: probabilistic approach." *International Journal of Information and Computer Security* 1.3 (2007): 298-314.
[11] Singh, Dilbag, Jaswinder Singh, and Amit Chhabra. "Evaluating overheads of integrated multilevel checkpointing algorithms in cloud computing environment." *International Journal of Computer Network and Information Security* 4.5 (2012): 29.
[12] Garg, Rachit, and Praveen Kumar. "A Nonblocking Coordinated Checkpointing Algorithm for Mobile Computing Systems." *IJCSI International Journal of Computer Science Issues* 7.3 (2010): 41-46.