Volume 3, Issue 4, April 2013 ISSN: 2277 128X
International Journal of Advanced Research in Computer Science and Software Engineering
Research Paper
Available online at: www.ijarcsse.com

Survey of Cluster based Adaptive Distributed Fault Diagnosis in MANET

Shabnam Parveen
Assistant Professor
Department of Computrer Sc.&Engg
JMIT Radour India

Avni Jindal
Research Scholar
Department of Computrer Sc.&Engg
JMIT Radour India

Abstract— Fault-diagnosis becomes an important building block to establish fidelity in MANET. Distributed system-level diagnosis is an important problem in MANET whose purpose is to have each fault-free mobile node to determine the state of all the mobile nodes in the system. The parameters such as diagnostic latency and message complexity are used for evaluating the proposed diagnosis algorithm Crash fault and value faults are challenging problem in MANET. Cluster based architecture is used for diagnosis the fault. The dynamic environments of nodes are used in mobile ad hoc network. Crash faults due to out of transmission range, battery depletion or physical damage. Value faults are due to improper communication of nodes. The faults are finding by the use of heartbeat testing mechanism.

Keywords— MANET, fault diagnosis, cluster, heartbeat, PMC model

1. INTRODUCTION

In Mobile Ad-hoc Network (MANET), groupings of wireless mobile nodes are produced as a ephemeral/short-lived network without any centralized infrastructure. Each node acts both as a router and as a host even the topology is changing rapidly [1]. MANET is to ensure communication routes are updated quickly and accurately. MANETs are self-forming, self-maintained, and self-healing networks. MANET is self-configuring network of mobile routers which is connected by the wireless links. Mobile ad-hoc networks have many features which distinguish them from other wireless networks. These factors are: dynamic network configuration, no fixed network infrastructure, node mobility and frequent node failure, low battery power which make routing in MANETs quite a challenging task [2]. MANET is suitable for the emergency situation like human induced disaster, military communication, medical situations etc.

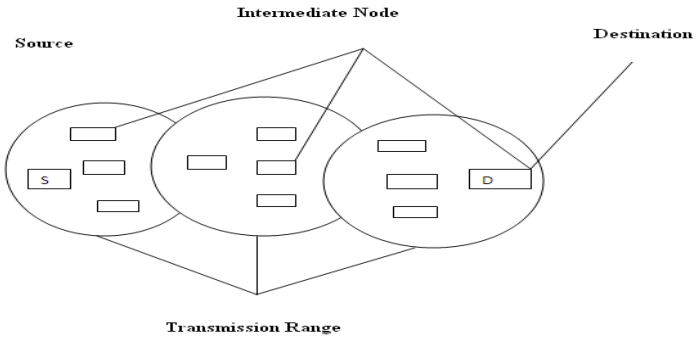

Figure 1: MANET [1]

In dynamic networking environment MANET provide communication with low cost. Distributed self diagnosis problem in dependable MANET. The failure detector has two main properties are completeness and accuracy [3]. In the traditional methods failure detector has not found the problem of scalability and message loss in wireless ad-hoc network. PMC model use the testing or tested approach. The comparison approach is used for fault diagnosis. If the outcome of comparison approach is 1 the nodes are faulty and result is mismatching or 0 then nodes are fault-free and result is matched [4]. Fault tolerances increase the system reliability. The invalidation model such as PMC fault model, comparison model, broadcast models are used for diagnosis approaches. Information analyzing, information gathering, resolving and diagnosis are three main segment of fault diagnosis in network.

2 Clustering

Three types of nodes which are chosen for Clustering schemes usually utilize to suppose different roles according to specific criteria.

Clusterhead nodes: An efficient cluster operation that has must be a support or backbone to sustain all vital control functions such as bandwidth allocation, forwarding inter-cluster packets, channel access, routing, virtual-circuit support, estimation of the routes for longer-distance messages and power control. In managerial roles; backbone takes the form of

connected clusterheads, linked either directly or via gateway nodes and they will have the subordinate nodes of that cluster connected to them.

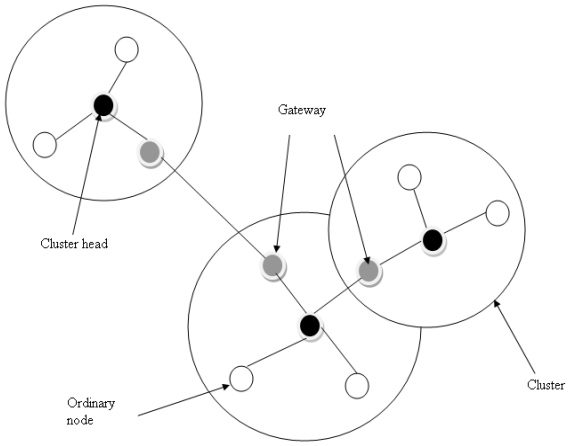

Figure 2: Cluster

2.2 Cluster Gateway Nodes: Node that works as the common or distributed access point for two cluster heads. Within the transmission range of two cluster heads a node is called as the ordinary gateway for two corresponding clusters.

2.3 Ordinary nodes (cluster member): An Ordinary nodes do not perform any other function beyond a normal node role. By the use of clustering schemes, improved spatial reuse, scalability, throughput and energy efficiency are achievable from better protocol performance of the MAC layer.

2.4 Advantages of Clustering Structure

The cluster architecture in MANET with a large number of mobile terminals ensures efficient performance. The cluster structure provides a certain amount of benefits.

2.4.1Aggregation of Topology Information: The clustering process assists in aggregate topology information so that each node is only required to store a small portion of the entire network routing information.

2.4.2Efficiency and Stability: The significant quality of a cluster structure is that it causes a MANET to seem smaller and more stable in the aspect of each mobile terminal.

2.4.3Communication Coordination: The process of clustering restricts the reach of inter-cluster interactions to cluster heads and also averts unnecessary exchange of messages amid the mobile nodes and thus can also conserve communication bandwidth.

2.4.4Routing Efficiency: Cluster structure can be one possible solution to improve the MAC layer efficiency and makes the routing process easier.

2.4.5Spatial Reuse of Resources: System capacity increase by storing the completed information once on the Cluster head, which facilitates the spatial recycle of resources [5].

3 Related Work

Sheng Xu, Symeon Papavassiliou proposes an algorithm based on the combination of fault tolerant routing and position-based routing techniques in computer networks. By using combination of these two concepts, some of the drawbacks allied with them, such as routing deadlock occurrences, and therefore generating a robust and fault tolerant routing strategy[6]. **Elias Procópio Duarte, Takashi Nanya** purpose a fully distributed algorithm that allows every fault-free node to achieve diagnosis in, $(\log_2 N)^2$ testing rounds. Nodes are mapped into gradually superior coherent clusters, so that tests are run in a hierarchical manner [7]. **Mohammad Moallemi, Mohammad Hossien Yaghmaee Moghaddam** propose Naimi-Trehel algorithm and distributed it independently on different clusters. They have used the hierarchical structure and the proposed algorithm supports fault tolerance capability for both temporary and permanent failures [8]. **Pabitra Mohan Khilar, Jitendra Kumar Singh** proposes a scalable failure detection service for large scale ad hoc networks using an efficient cluster based communication architecture. The proposed approach uses a heartbeat based testing mechanism to identify failure in each cluster [9].

4 Mobile Ad-hoc Routing Protocol

Ad hoc network routing protocols is divided into three type of routing protocols, which that depending on a different of routing protocols.

1. Table Driven/proactive Protocol
2. On-demand/reactive Protocol
3. Hybrid Protocol

4.1 Oriented routing table: The oriented routing table is an active routing environment in which the intervals between the wireless nodes will send medical information with more paths. On the basis of information each wireless node is gathered recently to change its route table. The original path is invalid, when the network topology changes or the establishment of any new path, all nodes will receive updates on the status path.

4.2 Demand-driven: In the demand driven, when required to send packets only it began to prepare to send the routing table. The source client node will call a path discovery process, when a wireless node requests to send data to another

wireless node, and stored in the registers of this path. The path is not valid until the expiration or the occurrence of conditions of the agreement with the first phase of a ratio of such agreements in each node. The main benefit of this agreement is that the use of lesser bandwidth, but the shortcoming is that not every wireless node that sends packets can always rapidly discover the path. The path discovery process can cause delays and the average delay time is longer.

4.3 Hybrid: Hybrid is an improvement of the both table-driven and on-demand routing protocol, or the combination of other equipment, such as Global Positioning System (GPS) and other equipment, participate in the study of mechanisms to facilitate the routing of the quick search, and data transmission [10].

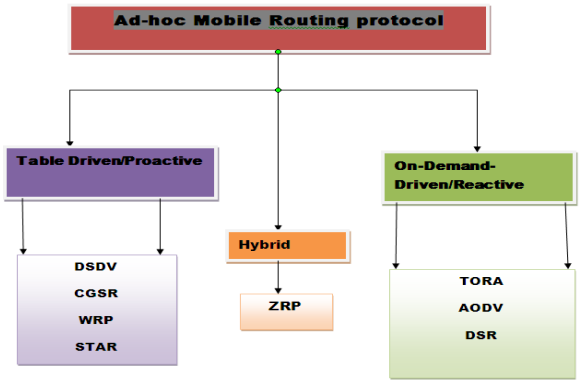

Figure 3: Mobile ad hoc routing protocol [11]

5 Faults in MANET

In order to exchange information, due to restricted transmission power in the network a node requires multiple hops in the MANETs. Therefore, maintenance and routing discovery are the major challenges to consider in MANETs.

5.1 Transmission errors

Due to high transmission congestion and contention, the MANET systems suffer from high transmission error rate. Therefore, under dynamic MANET system, it is important to provide higher reliability for broadcasting operation but it severe numerous problems. In a simple broadcast algorithm is proposed to improve the delivery ratio in an environment that has high transmission error rate.

5.2 Node or link failures

In ad-hoc networks, packet losses occur mainly due to link failures or node failures. Due to such failures, the effect on the network performance is based on various factors. Among such factors, one of them is the routing protocol.

5.3 Route breakages

One of the important causes of route failure is the node failure which may be because of power shortage.

5.4 Congested nodes or links

Congestion may occur when certain nodes or links may over utilize. This may lead to long delay or many packet losses. In a routing protocol for MANET is suggested that is aware and adaptive about network congestion [12].

5.5 Types of failure classes

Four possible classifications of failures are - value, timing, omission, and arbitrary. For a given set of inputs the system will be a specification of its correct behavior. The classifications are:

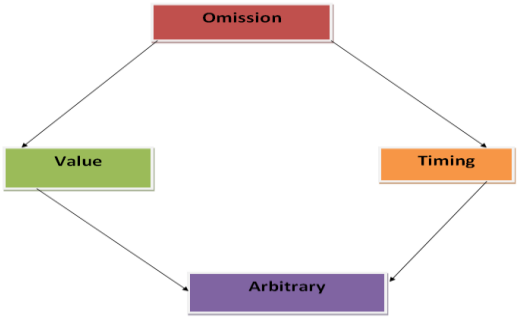

Figure 4: Fault classification Hierarchy [13]

Omission fault/failure: A component that does not respond to an input from another component, and the expected output is not producing, exhibiting fault is an omission fault and the corresponding failure an omission failure. An example of a component suffering from an omission fault is communication link which occasionally loses messages.

Value fault/failure: A fault that causes a component to respond within the correct time interval but with an incorrect value is termed a value fault. A communication link which delivers corrupted messages on time suffers from a value fault.

Timing fault/failure: A timing fault causes the component to respond with the correct value but outside the specified interval. Timing failures can only happen in systems which enforce timing constraints on computations.

Arbitrary fault/failure: It is possible for a component to fail in either the time or value domains in a manner which is not covered by one of the preceding classes. A failed component which produces such an output will be said to be

exhibiting an arbitrary failure (Byzantine failure). An arbitrary fault causes any violation of a component's precise behavior. Omission faults (failures) can be treated as a special case of value, and timing faults (failures).

6 Fault Diagnosis and its method

With the fast development of mobile ad hoc networks (MANETs), fault diagnosis has become a critical need to guarantee robust service for various applications. Fault identification is one of the important parts in many protocols. Diagnosis is classified based on the occurrence of fault. It is simply classified as static diagnosis and dynamic diagnosis.

In static diagnosis, the faults are not occurring during the diagnosis session. The faults can occur during the dynamic diagnosis session is difficult to handle because node can be faulty after it has been diagnosed as fault-free by other node. Several diagnosis methods have been adopted based either on invalidation models, such as comparison models and the generalized comparison model. The comparison model is most promising approach in which a set of task is assigned to nodes and outcomes are compared with their neighbor's outcomes. The generalized comparison outcomes can be 0 or 1[14].

7. Conclusion

Several approaches have been proposed for failure detection, including the heartbeat, probe and ack, comparison strategies. However, those approaches are not suitable when nodes are mobile. Faulty nodes cannot communicate with the other mobiles or behave unexpectedly and send unexpected results. For static diagnosis many protocols are introduced by researchers to identify the fault in ad- hoc network where node cannot change their status during diagnosis session. The fault (crash and value) identification in dynamic diagnosis is more complex than static diagnosis; during the diagnosis fault-free node can be faulty. After the study, we found that the presence of faulty node affects the efficiency and throughput of the network, which makes the network inconsistent. Also the above approaches lack of scalability and are not applicable to the large scale MANETs. Many researchers used clustering concept in their proposed algorithms. The drawbacks of those approaches are poor clustering algorithm and large failure detection time.

REFERENCES

[1] K. Vanaja, R. Umarani, "An Adaptive Fault Tolerant Multipath Routing (AFTMR) Protocol for Wireless Ad Hoc Networks" ISSN 1450-216X Vol.79 No.2 (2012), pp.180-190 © EuroJournals Publishing, Inc. 2012 http://www.europeanjournalofscientificresearch.com.

[2] Naveen Chauhan, Lalit Kumar Awasthi, Narottam Chand, Vivek Katiyar, Ankit Chugh "A Distributed Weighted Cluster Based Routing Protocol for MANETs" Wireless Sensor Network, 2011, 3, 54-60 doi:10.4236/wsn.2011.32006 published Online February 2011 (http://www.SciRP.org/journal/wsn).

[3] Mourad Elhadef, Azzedine Boukerche, and Hisham Elkadiki " An Adaptive Fault Identification Protocol for an Emergency/Rescue-Based Wireless and Mobile Ad-Hoc Network*"* 1-4244-0910-1/07/$20.00_c 2007 IEEE.

[4] Mourad Elhadef, Azzedine Boukerche and Hisham Elkadiki "A Dynamic Distributed Diagnosis Protocol for Wireless and Mobile Ad-Hoc Networks*"* 1-4244-0357-X/06/$20.00 © 2006 IEEE.

[5] Ismail Ghazi Shayeb, AbdelRahman Hamza Hussein, Ayman Bassam Nasoura "A Survey of Clustering Schemes for Mobile Ad-Hoc Network (MANET)" ISSN 1450-223X Issue 20(2011), pp.135-151© EuroJournals Publishing, Inc. 2011

[6] Xu, Papavassiliou, and Zakrevski, " Fault tolerant cluster-based approach in wireless mobile ad hoc networks" supported in part by New Jersey Institute of technology under Grant no.421050and in part by the New jersey Commission on Higher Education.pp.2613-2617,2001.

[7] Duarte E.P and Nanya T., "A Hierarchical Adaptive Distributed System-Level diagnosis algorithm", IEEE Transactions on computers, Vol. 47, no. 1,pp. 34 - 45 January (1998).

[8] Moallemi, Mghaddam, M .H.Y. and Naghibzadeh, "A Fault-Tolerant Mutual Exclusion Resource Reservation Protocol for Clustered Mobile Ad hoc Networks." Eighth ACIS International Conference on Software Engineering, Artificial Intelligence, Networking, and Parallel/Distributed Computing., pp. 528-533, Vol.2, 2007.

[9] Khilar, P.M;Singh, J .K. and Mahapatra, S. "Design and Evaluation of a Failure Detection Algorithm for Large Scale Ad Hoc Networks Using Cluster Based Approach", in proc. of IEEE International Conference on Information Technology, Bhubaneswar, India, pp.153-158 (2008).

[10] Saleh Ali Alomari and Putra Sumari, " Multimedia Applications for MANETs over Homogeneous and Heterogeneous Mobile Devices".

[11] Kathryn Higgins, Ruth Egan, Shonagh Hurley and Marine Lemur "Ad Hoc Networks" 4BA2 Technology Survey.

[12] SWATI SAXENA, Dr. MADHAVI SINHA"A study of Adaptive Replication Technique in routing time-constrained messages (VoIP) in MANET" Swati Saxena et al. / International Journal on Computer Science and Engineering (IJCSE) ISSN.

[13] Chessa, S. and Santi, P. "Comparison-Based System-Level Fault Diagnosis in Ad Hoc Networks" appeared in reliable distributed system, 2001, procedding 20th IEEE symposium, pp.257-266, 2001.

[14] Elhadef, M. and Boukerche, A., "A Failure Detection Service for Large-Scale Dependable Wireless Ad-Hoc and Sensor Networks" Second International Conference on Availability, Reliability and Security (ARES2007),pp.182-189,2007.

