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Mobile Ad Hoc Grid Architecture Based On Mobility of Nodes

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ABSTRACT: Mobile network system consists of mobile nodes which are movable in nature. Each node consists of different kind of mobility patterns, energy. This will make it more difficult to form a mobile adhoc network. To overcome this grid architecture has been initiated. The main concept behind grid architecture is the sharing of resources within the same network. Thus assigning resources for each devices will greatly reduce the load of the network. The mobility of nodes are resolved by careful determination of stability time and position of mobile nodes

KEY WORDS: Mobilea dhoc grid, Mobility, Stability

I. INTRODUCTION

In a mobile ad hoc network (MANET) [8], a collection of mobile hosts with wireless network interfaces to form a temporary network without the aid of any fixed infrastructure or centralized administration. A MANET is referred to as an infrastructure less network because the mobile nodes in the network dynamically set up paths among themselves to transmit packets temporarily. In other words a MANET is a self-configuring network that is formed automatically by a collection of mobile nodes without the help of a fixed infrastructure or centralized management. Each node is equipped with a wireless transmitter and receiver, which allow it to communicate with other nodes in its radio communication range. In order for a node to forward a packet to a node that is out of its radio range, the cooperation of other nodes in the network is needed, this is known as multi-hop communication.

Therefore, each node must act as both the host and the router at the same time. The network topology frequently changes due to the mobility of mobile nodes as they move within, move into, or move out of the network. In a MANET, nodes within each other's wireless transmission ranges can communicate directly; however, nodes outside each other's range have to rely on some other nodes to relay messages. Thus, a multi-hop scenario occurs, where several intermediate hosts relay the packets sent by the source host before they reach the destination host. Every node functions as a router. The success of communication highly depends on other nodes cooperation.

Mobile grid architecture [7] overcomes the problems faced by adhoc architecture. The devices are integrated to form a grid architecture. Effective resource sharing is the concept behind grid architecture. A grid by definition is a system that coordinates resources that are not subject to centralized control. The fundamental functions in a grid are resource discovery, negotiation, resource access, job scheduling and authentication. In mobile adhoc grid architecture the mobile nodes are allowed to form inside a grid in order to reduce the burden of the network. Since all the nodes are internally connected to each other resource sharing will be made easy. Thus the GHN,SPN,CN all appear inside the grid which performs variety of operations thus sharing the necessary resources to the customer node. Since the resources are shared there is no need for any central authority which is the major disadvantage of MANETS.Each node can be act as a GHN,SPN,CN and CA itself.

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In MANET, nodes are free to join and leave the network at any time in addition to being independently mobile. Consequently, a mobile ad hoc network is vulnerable to many kinds of malicious attacks, and it is thus difficult to ensure secure communications. Malicious nodes directly threaten the robustness of the network as well as the availability of nodes. Protecting legitimate nodes from malicious attacks must be considered in MANETs. This is achievable through the use certificates or so called node ID's. Each node is assigned by a specific Id or Certificate.

Whenever the node is detected as a threat to the network its Id or certificate is revoked [20] from the network ,thus by securing the whole network system.The revocation mechanism is already been done for adhoc networks. Hence , it is now being applied to a sharing architecture called Mobile adhoc grid architecture.

II. RELATED WORK

Grid architecture allows the network to share and use resources available efficiently without any problem between them.Several researchers have been done some works related to grid architecture they are as follows:

Ihsan et al [7] have proposed a mobile ad hoc service grid that maps the concepts of grid on to adhoc networks. This mobile ad hoc service grid uses the under-lying connectivity and routing protocols that exist in ad hoc networks. The availability of the service in a node is broadcast to all one-hop neighbors. Since the grid is formed within one-hop neighbors, there is a chance for resource discovery to fail when there is no service provider within one hop. In this grid, each node is responsible for maintaining the resource look up table, which can be a burden to devices with less storage capabilities.

Wang et al [8] have proposed a mobile agent based approach for building computational grids over mobile ad hoc networks (MANET). Here, the mobile agent has been used to distribute computations and aggregate resources. The mobile agent searches for resources and executes the computations on the node that is willing to accept it and is responsible for negotiation of resource provision for running the computation job.

Anda et al [9] have proposed a computing grid over a vehicular ad hoc network (VANET) by leveraging inter-vehicle and vehicle to-roadside wireless communications. This grid has been used for solving traffic related problems by exchanging data between vehicles. Forming a grid is not a problem in VANETs, because the vehicles have ample power and energy and can be equipped with computing resources.

Roy et al [10] have investigated the use of the grid as a candidate for provisioning computational services to applications in ubiquitous computing environments. The competitions among grid service providers bring in an option for the ubiquitous users to switch their service providers, due to unsatisfactory price and QoS guarantees.

Our approach varies from the above mentioned works and we have used trace based approach in order to trace the mobile nodes to form grid architecture.

III. PROPOSED ARCHITECTURE FOR GRID FORMATION

The stability of the grid is the major challenge in mobile grid. Since the nodes are allowed to move freely inside the network it is difficult to form a grid with these mobile nodes.A Mobile Ad-Hoc Network (MANET) is a self-configuring network of mobile nodes connected by wireless links, to form an arbitrary topology. The nodes are free to move randomly. Thus the network's wireless topology may be unpredictable and may change rapidly. Minimal configuration, quick deployment and absence of a central governing authority make ad hoc networks suitable for emergency situations. However, in future MANETs are expected to be used in various applications with diverse topography and node configuration. Widely varying mobility characteristics are expected to have a significant impact on the performance of the routing protocols like AODV. The overall performance of any wireless protocol depends on the duration of interconnections between any two nodes transferring data as well on the duration of interconnections between nodes of a

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data path containing n-nodes. If nodes change their location over time, they have to update their location estimates frequently in order to avoid inaccuracies resulting from using outdated location estimates. Moreover, node movement during the measurement of parameters needed for location computation can cause inaccuracies in the estimated location.

a. Parameters Associated

To overcome this mobility problem we are going to use the following parameters

- Position
- Stability time

1. Position

Whenever the nod joins the network it will keep on sending the information about its position. The position table will be updated once the node starts to move from one particular place to another. This will help to determine the status of the particular node. Once the status has been determined it is useful to determine the type of nodes.

2. Stability Time

The stability time of the mobile nodes are determined to understand the patter and the manner in which the nodes are moving .The stability time gives the approximate time of the nodes in which they are available in a particular position for a particular period of time

b. Grid Table

The grid table consists of the details about each and every node in the network. The nodes are differentiated into head nodes, customer nodes and service provider node. The table consists of the details about position and the stability time of the nodes which are further used for communication between the nodes. The tables keep on updating due to the mobility of the nodes.

The below**Fig 1.1** represents the overall system architecture for grid formation. Initially the process starts with the mobile nodes.The positions and the stability time of the nodes are assigned at random since they move freely around the network. After all the process has been finished a grid table is formed which contains the details about the nodes inside the network.The grid table is then used for the resource allocation for the necessary customer and service provider nodes

The resource management part of the system performs the Process of allocating necessary resources to the nodes in the network.The resources are the back bone of the mobile adhoc architecture. They are shared between the nodes efficiently using the available grid resources.

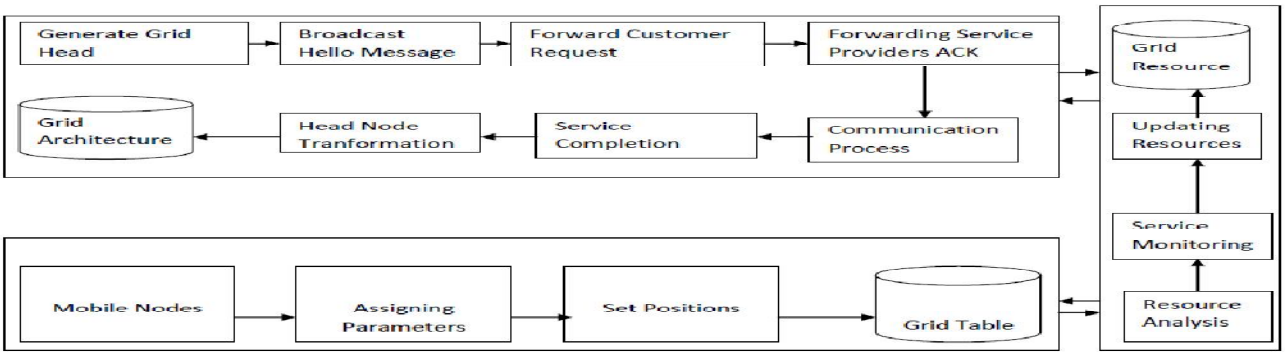

FIGURE 1.1 OVERALL BLOCK DIAGRAM

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IV. GRID FORMATION

The node willing to provide service is called service provider node (SPN) and the node which requires that service is called service provider node.The service provider node which has high stability time near the both customer node and service provider node will act as the Grid head node (GHN).The GHN is responsible for the communication process happening between the SPN and CN.Grid formation is the goal of the system. It starts with the grid table. The grid table is formed by using the available information about the nodes being implemented. The positions of the nodes are set to be in random manner. Resource management phase acts the middleware between grid initiation and grid formation. The resources are initially identified and the nodes which are requesting that resources have been found out. The resources are allocated to that particular node by using the service monitoring. The resources are updated once the new GHN has been formed. Hence the necessary functionalities are assigned to the GHN thus by servicing the CN by the SPN.

V. RESOURCE ALLOCATION

The node willing to provide service will broad cast the hello packet throughout the network. The hello packet pattern is described in.The table consists of Node ID, Stability time and Hello ID.The node which needs the service will send the service request message to the SPN.The format of the message is shown in Table. The node willing to provide the service to the request will provide the Grid joining message to the SPN.

a. Resource Management

The grid head node act as the centralized server for the communicationprocess. Once the CN request for the service it will look up the grid joining message to select the suitable SPN to allocate it to the required CN.Once the service is allocate it will starts to serve the customer node. The process will be monitored by the Grid head node. After successful completion of the communication the service provider will send the completion message and the customer node will provide the acknowledgment message to the GHN.

The SPN after one successful completion it will send the terminate message if the node willing to exit from the service or it will provide the WTC (WillingTo Continue) message if the service provider node wants to continue the service. The SPN will send the denial-of-service message if the SPN doesn't ready to provide the service. The major job of the GHN is not only control the communication but also broadcasts the hello packets throughout the network such that it will inidicate it is "alive" and it will allow the new nodes can join the Grid architecture.

The Grid head node will keep the table updated throughout the communication process, and will hand over the table details to the next GHN for successful communication. When network merge happens it will not affect the existing grid, instead new members will join the grid. But this situation will not happen frequently in a low mobile scenario

VI. PERFORMANCE EVALUATION USING SIMULATION

Simulation mechanisms are used to evaluate the Grid architecture. The simulation tool used is NS2.The parameters used for the simulation are given in Table 2.

Table2. Parameters used in NS2

Parameter	Value
Node Placement	Random Distribution
Number Of Nodes	100

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Terrain Dimensions	1000m x 1000m
Transmission Range	250m
Simulation Time	600s
Routing Protocol	AODV

a. *Job Completed*

The job completed in grid architecture is defined as the amounof job completed by the SPN and CN provided the CN is fixed constant.

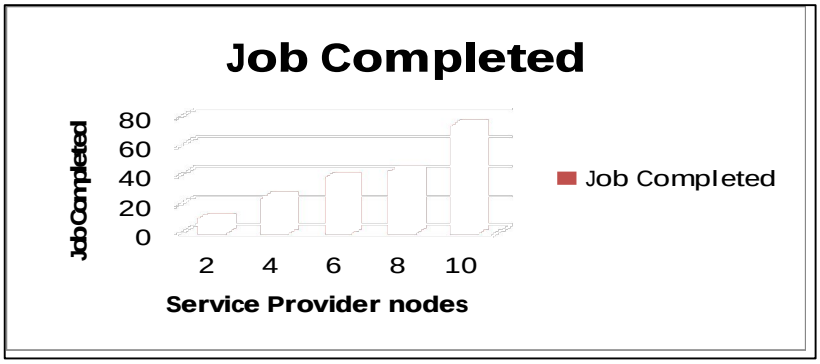

Figure 5.A Service Provider nodes vs Job Completed graph. Here X-Axis denoted the number of service providers and the Y-Axis denotes the number of jobs completed. The jobs completed increases linearly.

Thus from the above evaluations by increasing the customer nodes we can complete more number of jobs where the service provider node is static and it is fixed as 5.

b. Control Packets

This parameter gives the value of the number of control packets needed in order to form the grid. The outcome shows that the number control parameters needed in order to form a grid increases rapidly as we increase the number of customer nodes.

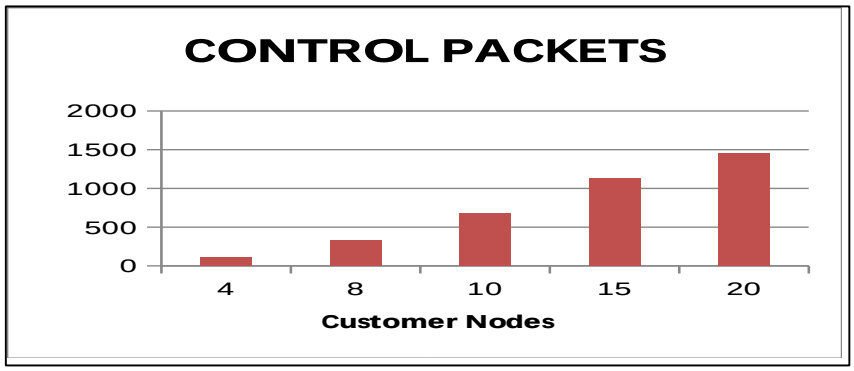

Figure 5.B Customer nodes vs Control packets graph. Here X-Axis denoted the number of Customer nodes and the Y-Axis denotes the number of Control Packets sent. The control packets forwarded increases linearly.

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c. Energy Utilized

The energy level utilization is defined as the amount of energy utilized by the mobile nodes in the grid architecture to the amount of energy level available

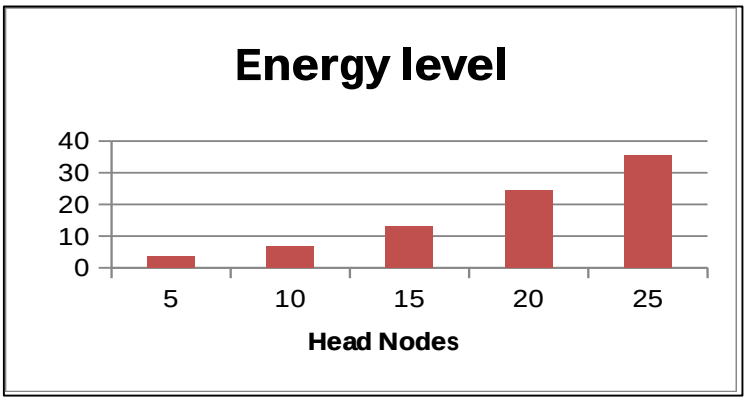

Figure 5.C Grid Head nodes vs Energy Utilization graph. Here X-Axis denoted the number of Head nodes and the Y-Axis denotes the amount of energy used. The Energy used is fount to increase linearly.

From the above mentioned three parameters evaluation we conclude that the grid architecture is performing well after considering the stability and position of the mobile nodes.The energy has been used wisely.

VII. CONCLUSION AND FUTURE WORK

As expected grid architecture has been formed by using the mobile nodes. The mobility of the nodes which is the major problem in the MANET has been resolved by clearly evaluating the Position and stability parameters of the mobile nodes. The mobile nodes are thus allowed to freely inside the grid architecture. The transmission process has been done by using the service provider nodes to the customer nodes and the necessary resources are allocated to the service provider nodes by using the grid head nodes .The grid head node shared the resources among the service providers by itself without the use of any Central authorities which simplifies the process. Since resources are shared load inside network has been maintained without any traffic or delay. Hence, a grid architecture using the mobile nodes have been designed and implemented.

Even though the mobile adhoc grid architecture efficiently shares the resources,security [14][15]is still being unaddressed. The future work on this paper purely depends on securing the mobile adhoc grid architecture. For this work the following mechanisms are going to be followed

- Attack Detection
- Certificate Verification Certificate Revocation
- Recovering Falsely Accused Certificates
- Attack Prevention

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