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A Review: Novel Protocol for Clumping in Mobile Ad hoc Networks

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ABSTRACT: Mobile ad hoc networks (MANETs) is the combination of three words 1. Mobile(Movable or Transportable) 2. Adhoc(Temporary or for specific purpose) 3. Networks(Flexible data applications which use networks to communicate) or A MANET can be defined as a system of autonomous mobile nodes that communicate over wireless links without bounded, defined or fixed infrastructure. MANETs are useful in places that have no communications infrastructure. Mobile adhoc network is a type of ad hoc network that can change locations and configure itself on the fly. Base station plays a very important role in infrastructure based cellular networks . But to create a base station in infrastructure less network is very difficult because of movable of nodes. Mapping the logic of base stations into mobile ad hoc networks leads to the design of logical clump, where the ch(clump head) in every clump play the role of base station. So clumping is very important in this type of networks . The aim of this research work is to enhance the network lifetime , proper balancing the power consumption among mobile nodes and increase the throughput of the networks. For this type of architecture we have design some protocols and algorithms which are : Closer Clump Detection Protocol (CCDP) , Energy Efficient Based Clumping Algorithm (EEBCA) and A Broadcasting Range Adjustment Protocol (BRAP) has been proposed which allows the isolated nodes to adjust their ranges to remain connected with existing clump heads. Each of the work is evaluated separately to analyze their performances and compared with the competent results.

KEYWORDS: MANET, Clumping, Clump head, CCDP, EEBCA, BRAP.

I. INTRODUCTION

A Mobile Adhoc Network is a group of mobile nodes that can communicate to each other with out any fixed base station . The mobile nodes that are in clump range of each other can directly communicate, whereas others needs the aid of intermediate nodes to route their packets. Each of the node has a wireless interface to communicate with each other. These networks are fully distributed, and can work at any place without the help of any fixed infrastructure as access points or base stations. Fig.1. shows a simple adhoc network with 5 nodes. Node 1 and Node 2 in clump 1 are in range can communicate directly with each other and Node 4 and Node 5 in clump 2 are in range can communicate directly with each other but Node1 and node 4 are not within range of each other, however the node 3 can be used to forward packets between node 1and node 4. Here the node 3 will act as a router and these five nodes together form an adhoc network.

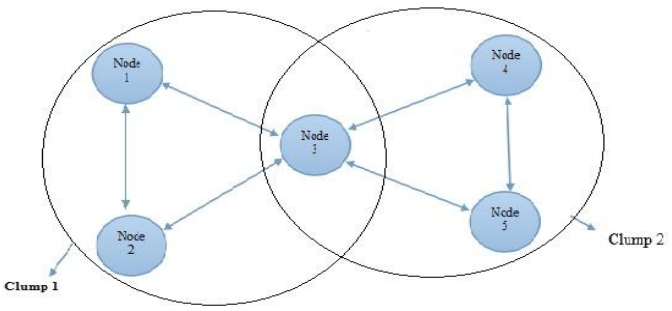

Fig. 1 Example of mobile adhoc network

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A. Technologies of Mobile Adhoc Networks

Wireless Network plays a very important role in the field of network communication .Generally, in wireless personal area network , wireless local area network and mobile adhoc network three main technologies are used and they are: IEEE 802.11 family of protocols, the high-performance LAN (HiperLAN) protocols and Bluetooth

IEEE 802.11: it is very popular and widely used Wi-Fi technology which is based on the IEEE 802.11 specifications. Under the IEEE 802.11 standard, the mobile nodes in a network can work in two different modes. First one is infrastructure mode and second one is adhoc mode. Infrastructure mode wireless networking connects a wireless network to a wired network. It also supports central connection points for WLAN clients. A wireless access point is required for infrastructure mode wireless networking. There are already significant empirical studies discussing about testing effectiveness and quality but no systematic review have been done for summary and classification of all the combined approaches. In this research the state of art about combined software quality assurance will be presented. This research will cover the empirical research in this area.

HIPERLAN: The European counterparts to the IEEE 802.11 standards[12] are the high performance radio LAN (HIPERLAN) standards defined by the European Telecommunication Standards Institute (ETSI). While IEEE 802.11 standards can use either radio access or infrared access, the HIPERLAN standards are based on radio access only . Four standards have been defined for wireless networks by the ETSI.

•HIPERLAN/1: It is a wireless radio LAN (RLAN) without a wired infrastructure, based on one-to-one and one-to-many broadcasts. It is well studied for both adhoc and infrastructure based networks. The standard covers the physical layer and the media access control part of the data link layer. The features of the standard include the transmission range of about 50m at a rate of 23 Mb/s.

•HIPERLAN/2: It has a transmission range of about 200mts for wireless Asynchronous Transfer Mode (ATM) networks. It offers a wide range of data rates from 6 Mbps to 54 Mbps and uses 5GHz radio frequency. It supports centralized and direct modes of operation. The former is used in the cellular network topology whereas the latter is used in adhoc network topology. Basic services in HiperLAN/2 are data, sound and video transmission with emphasis given on the quality of service (QoS). This layer can also be used on the physical layer to connect IP and ATM networks. This feature makes HiperLAN/2 suitable for the wireless connection of various networks.

•HIPERLAN/3: It is also called as HIPERACCESS network that enables establishment of outdoor high speed radio access networks providing fixed radio connections to customer premises. It has a range of 500mts and provides a data rate of 25Mbps. This network can be used for wireless local loop (WLL) communications.

•HIPERLAN/4: It is also called as the HIPERLINK standard that provides high speed radio links for point-to-point static interconnections. The transmission has a range of about 200mts and operates on the 17GHz frequency range. It provides a data rate of 155 Mbps.

BLUETOOTH: Bluetooth is a technology for wireless body area network (WBAN) and wireless personal area network (WPAN) that provides short range radio links between portable devices such as mobile PCs and mobile phones. Bluetooth specifies 10mts radio range and supports up to seven devices in a master slave mode. The master permits slaves to transmit by allocating slots for voice or data traffic. Bluetooth uses a combination of circuit switching and packet switching.
Bluetooth wireless networks are classified into two network topologies named piconets and scatternets. In a picnic, two or more slave devices can share the same frequency hopping sequence. A piconet comprises one master station and up to seven active slaves can participate in data exchange. So it can form a point-to-point or point-to-multipoint design. A direct link can exist between a master and a slave but not between slaves. So data exchange between the slaves has to be routed through the master. Independent piconets that have overlapping coverage areas may form a scatternet. A scatternet exists when a station is active in more than one piconet at the same time. A slave can communicate with the different piconets it belongs to, in a time-multiplexing mode. When two piconets overlap, the master of one piconet serves as the slave of the other piconet. No device can serve as a master of two piconets. When more piconets overlap

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with each other, one master serves as a slave of two piconets. Thus multihop communication can be achieved through the scatternet concept, where several masters from different piconets can set up links among each other. The bluetooth applications span from wireless headset to PDAs, networked computer peripherals like printers, scanners, digital cameras etc.

B. MANETs characteristics

1) Distributed operation: There is no background network for the central control of the network operations, the control of the network is distributed among the nodes. The nodes involved in a MANET should cooperate with each other and communicate among themselves and each node acts as a relay as needed, to implement specific functions such as routing and security.

2) Multi hop routing: When a node tries to send information to other nodes which is out of its communication range, the packet should be forwarded via one or more intermediate nodes.

3) Autonomous terminal: In MANET, each mobile node is an independent node, which could function as both a host and a router.

4) Dynamic topology: Nodes are free to move arbitrarily with different speeds; thus, the network topology may change randomly and at unpredictable time. The nodes in the MANET dynamically establish routing among themselves as they travel around, establishing their own network.

5) Light-weight terminals: In maximum cases, the nodes at MANET are mobile with less CPU capability, low power storage and small memory size.

6) Shared Physical Medium: The wireless communication medium is accessible to any entity with the appropriate equipment and adequate resources. Accordingly, access to the channel cannot be restricted.

C. Advantages of MANET

Some of the advantages of an Adhoc network are:

1) They provide access to information and services regardless of geographic position.
2) Independence from central network administration. Self-configuring network, nodes are also act as routers.
3)Addition of new nodes in the network is very easy .
4) Better Flexibility.
5)It is robust due to decentralize administration.
6) It can be set up at any place and time.
7) It is less expensive as compared to other network(wired network) etc.

D.Applications of MANET

There are two main areas where MANET technology can be applied.

The first area extends the current wired and wireless networks by adding new mobile nodes that use MANET technology at the edge of the network. These could be, for example, drivers in a city who can communicate with each other while obtaining traffic information, students on a university campus, company employees in a meeting room, and many other similar situations. Perhaps one day MANETs, will replace the existing wireless telephony if every user is willing to store and forward data packets with his wireless device.

The second area where MANET technology can be applied is where a communication network is needed, but there is no infrastructure available, or the pre-existing infrastructure has been destroyed by a disaster or a war. MANETs can be

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used in any situation that involves an emergency, such as search-and-rescue operations, military deployment in a hostile environment, police departments, and many others. In addition, the lack of a wired Infrastructure reduces the cost of establishing such a network and makes MANETs a very attractive technology.

Some of the typical applications include:

Military battlefield: Adhoc networking would allow the military to take advantage of commonplace network technology to maintain an information network between the soldiers, vehicles, and military information head quarter.
Collaborative work: For some business environments, the need for collaborative computing might be more important outside office environments than inside and where people do need to have outside meetings to cooperate and exchange information on a given project.

Local level: Adhoc networks can autonomously link an instant and temporary multimedia network using notebook computers to spread and share information among participants at a e.g. conference or classroom. Another appropriate local level application might be in home networks where devices can communicate directly to exchange information.

Personal area network and bluetooth : A personal area network is a short range, localized network where nodes are usually associated with a given person. Short-range MANET such as Bluetooth can simplify the inter communication between various mobile devices such as a laptop, and a mobile phone.

Commercial Sector: Adhoc can be used in emergency/rescue operations for disaster relief efforts, e.g. in fire, flood, or earthquake. Emergency rescue operations must take place where non-existing or damaged communications infrastructure and rapid deployment of a communication network is needed.

E. MANETs Challenges

Limited bandwidth: Wireless link continue to have significantly lower capacity than infra structured networks. In addition, the realized throughput of wireless communication after accounting for the effect of multiple access, fading, noise, and interference conditions, etc., is often much less than a radio's maximum transmission rate.

Dynamic topology: Dynamic topology membership may disturb the trust relationship among nodes. The trust may also be disturbed if some nodes are detected as compromised.

Routing Overhead: In wireless adhoc networks, nodes often change their location within network. So, some stale routes are generated in the routing table which leads to unnecessary routing overhead.

Hidden terminal problem: The hidden terminal problem refers to the collision of packets at a receiving node due to the simultaneous transmission of those nodes that are not within the direct transmission range of the sender, but are within the transmission range of the receiver.

Packet losses due to transmission errors: Ad hoc wireless networks experiences a much higher packet loss due to factors such as increased collisions due to the presence of hidden terminals, presence of interference, uni-directional links, frequent path breaks due to mobility of nodes.

Mobility-induced route changes: The network topology in an ad hoc wireless network is highly dynamic due to the movement of nodes; hence an on-going session suffers frequent path breaks. This situation often leads to frequent route changes.

Battery constraints: Devices used in these networks have restrictions on the power source in order to maintain portability, size and weight of the device.

Security threats: The wireless mobile adhoc nature of MANETs brings new security challenges to the network design. As the wireless medium is vulnerable to eavesdropping and ad hoc network functionality is established through node

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cooperation, mobile adhoc networks are intrinsically exposed to numerous security attacks.etc.

F. CLUSTERING ALGORITHMS IN MANET:

Here we describe the following clustering algorithms:

1) Linked Cluster Algorithm(LCA):The linked cluster algorithm (LCA) performs the job of initial three tasks such as topology sensing, clusterformation and cluster linkage whereas the link activation algorithm (LAA) performs the job of link activation betweenthe nodes in the network. The routing algorithm covers the details of the routing operations for packet communication.The objective of the current work is to focus on the basis of neighborhood detection in changing topology andclusterformation.LCA could not meet certain criteria of the adhoc network, but could become the base algorithm forother benchmark algorithms.

2)Lowest ID Algorithm(LID):In this algorithm, every node is assigned with a unique non-negative identification number which is the decidingfactor for the status of a node. In a mobile packet radio network, anode has no a priori knowledge of the locations ofother nodes as well as the connectivity of the network. So, as a first task when the network comes up, the connectivityamong the nodes is discovered by every other node. This is accomplished by every single node that broadcasts its ownID to its neighbors. At the same time it also receives the same from its neighbors. If a node listens to all the IDs that arehigher than its own ID, then it declares itself as the cluster head among its immediate neighbors. And the neighbornodes whose status is not yet decided become the members of the newly selected head. This process is repeated till allthe nodes are assigned with the role of ahead or a member of a cluster.

3) Highest Connectivity Algorithm(HC):The main aim of this algorithm is to reduce the number of clusters in the network. In every cluster there exists a cluster head thatbelongs to the dominating set. In the HC algorithm, a node having highest degree of connectivity is selected as thecluster head. And the adjacent node whose status is not yet decided becomes the member of the selected cluster head. Ahigher degree of connectivity ensures efficient service to the member nodes by minimizing the number of heads. Herethe efficiency means lowering the delay in communication through the head nodes.

4)Mobility Metric Based Algorithm (MOBIC): The algorithm uses mobility based metric as cluster formation basic and calculation of weights of the nodes in thenetwork. MOBIC works almost same as the Lowest ID algorithm, where the node IDs are replaced by the relativemobility metrics of each node. In MOBIC the need of collecting the relative speed information from the neighborsdegrades its performance, because continuous movement of the nodes in MANET may provide inaccurate mobilityinformation during cluster set up time.

5)Distributed Mobility Adaptive Algorithm (DCA, DMAC): This algorithm is a generic weight based cluster formation algorithm.DCA does not allow the change in networktopology during the execution of the algorithm. A node having bigger weight among all its one-hop neighbors isselected as the cluster head. DMAC claims to be the most suitable algorithm for the cluster formation and maintenancein the presence of node mobility. It starts with the assumption that every node knows its own ID, weight and status inthe network as well as the same for its one-hop neighbors. This proves that the cluster head is selected only with theknowledge of its local topology.

6)Weighted Clustering Algorithm(WCA):In WCA re-election takes place with the occurrence of certain events i.e., when there is a demand for it. Nodeparameters like degree of connectivity, mobility, transmission power and available battery power are considered forselection of a cluster head and are given different weights depending on the network scenario. For example, sensornetworks where energy is a major constraint, battery power could be given higher weight.

7)TACA(Topology adaptive clustering algorithm) :The main aim of TACA is to selects minimum number of cluster heads to minimize the number of nodes in the virtual back bone. The features of TACA are The nodes in the ad hoc network are capable to increase or decrease their transmission range. But there is a max range . Battery power and mobility of nodes are taken as weight deciding factor A cluster head is selected when the network is first activated. As a node drains its battery power completely, it becomes dead and is removed from the network.
Disadvantage: TACA selects two kinds of cluster heads volunteer and non-volunteer so flooding occurs. It is not

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energy efficient as it does not take transmission power and cardinality of nodes into account while calculating weight factor.

II. RELATED WORK

In [1].Authors proposed a Mobility based Clustering Algorithm for MANET. This algorithm is distributed in nature that each node decide its own role. It reacts to the unpredictable topology change and can manage link failure and new link. The weight of the cluster head is calculated by mobility and energy of the nodes. The node having low mobility and high energy is elected as cluster head. To measure the performance of the network parameters used are node life time, number of formation of cluster head with varying number of nodes and packet delivery ratio.In[2]. Author proposed a cluster-based reputation scheme for secure MANET. It uses the watchdog and delegation process to make secured network. In this paper four mechanisms are used for maintain the secure network. Delegation and isolation mechanism to detect the malicious node and send it to blacklist on the bases of reputation table. Rehabilitate mechanism to allow the node enter into the network if it started well behave later. Delegation mechanism used to give the functionalities of cluster head to the member node when the residual energy of the CH reaches the Min_threshold. And topology change mechanism to handle the mobility of member node. In [3]. The author represents the proposed a Robust Clustering Algorithm in this paper. Power, Mobility and Workload are the three parameters used to form and maintain more stable cluster. Weight of the node is calculated on the bases of remaining power, mobility prediction (if a node moves along with all its 1-hop neighbours) and workload represented by PDR (power decrease rate). Result is simulated using NS-2 that depict of lower re-election of cluster head. In [4] the authors describes Mitigate Routing Misbehavior in mobile ad hoc network. Watchdog and pathrater tools are used to detect and mitigate the routing misbehavior. Watchdog is to detect the misbehavior of node in the network and pathrate helps routing protocols avoid the nodes that agree to forward the packet but unable to do so. Implementation of watchdog and pathrater is done on the dynamic source routing protocol. And the parameter uses to evaluate the performance are throughput, percentage of overhead transmission, and the accuracy of misbehaving nodes. In [5] paper describes a Signal and Energy Efficient Clustering (SEEC) based routing algorithm. Signal strength and energy level are the two things are considered to enhance the performance of network. The purpose of this algorithm is that to keeps head always alive & avoids re-election of cluster head and takes care of cluster head by maintaining both battery power level and signal strength. Finally this algorithm improve network lifetime of cluster head. In [6] This paper describes a new mechanism called Energy Efficiency and Secure Communication Protocol (EESCP) is to divide the MANET into a set of 2-hop clusters where each node belongs to at least one cluster. The nodes in each cluster elect a leader node (cluster head) to serve as the IDS for the entire cluster. To balance the resource consumption weight based leader election model is used, which elected an optimal collection of leaders to minimize the overall resource consumption and obtaining secure communication using diffie-Hellman key exchange protocol. In [7] Authors designed and implemented a dynamic energy efficient clustering algorithm that increases the network lifetime. They proposed a model that elects first the nodes that have a higher energy and less mobility as cluster-heads, then periodically monitor the cluster-heads energy and locally alter the clusters to reduce the energy consumption of the suffering cluster-heads. They compared the proposed algorithm with weight clustering approach and found that the results outperformed the weight clustering approach in all scenarios. In [8] authors proposed a topology adaptive clustering algorithm for mobile ad hoc network that ensures better cluster stability and enhances the network life time by keeping a record of previous n set of movements of every node to predict their average mobility. To improve the cluster stability a node with lower mobility and higher battery power has been chosen for cluster head. The selection of non-volunteer nodes reduces the number of global reelection complexity and load on individual nodes. In [9],Presented by two distributed algorithms DCA (Distributed Clustering Algorithm) and DMAC (Distributed and Mobility-Adaptive Clustering) that requires only knowledge of the local topology at each node and allows each ordinary node to have direct access to at least a cluster head, thus uaranteeing fast inter and intra cluster communication between each pair of nodes. A weight based criteria has been introduced for the cluster formation that allows the choice of the cluster heads based on node mobility related parameters. In [10] the authors proposed a local approach for the cluster heads election in a new distributed Mobility Prediction-based Weighted Clustering Algorithm with Local cluster-heads election (MPWCA-L). They have shown that their algorithm ensures a better stability of the dominant set and a better quality of service than WCA. Results show that their algorithm provides a better stability than WCA while the speed is increasing. In [11] the authors presented a methodology for building distributed and dynamic virtual topology in ad hoc networks based on the

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concept of dominating sets. Their network topology can adapt to different mobility scenario without overhead. Their algorithm minimizes the number of exchanged messages and has the advantage of supporting scalability.

III. PROPOSED ALGORITHM

For increasing the network life time , increasing throughput , minimize delay rate of packets , Increasing packet delivery ratio, limited bandwidth and reduce maintenance overhead etc. of mobile adhoc network . Following algorithm and protocol have been proposed for the efficient design of clumping in mobile adhoc network and evaluated separately to analyse their performances and compared with the competent results.

A. Closer Clump Detection Protocol (CCDP): Through this protocol we design a closer clump of nodes and in this closer clump, every node transmit its own information to the network, so that this information is received by a node which lies within its transmission range. The receiver senses its closer node and updates its neighbour table from time to time. This protocol is checked through simulation by using network simulator (NS2) prior to its implementation.

B. Energy Efficient Based Clumping Algorithm (EEBCA): The main aim of this algorithm is that to calculate the node mobility and its battery power for declaring a clump head . A node having the highest weight among its immediate neighbours declares itself as the volunteer clump head. As the current head consumes its battery power beyond a threshold, non-volunteer clump heads are selected locally. The algorithm aims to utilize the battery power in a fairly distributed manner so that the total network life time is enhanced with reduced clump maintenance overhead. During the process of clumping, some isolated heads without having any members are formed. This increases the delay in communication as the number of hops in the routing back bone is increased.

C. Broadcasting Range Adjustment Protocol (BRAP): The broadcasting protocol has been proposed that allows the isolated nodes to adjust their ranges to remain connected with existing clump heads. The results show that, BRAP reduces the delay in communication by reducing the number of clump heads in the network. Validation for the base protocol CCDP and algorithm EEBCA are made through simulation by using the NS2 tools.

IV. CONCLUSION AND FUTURE WORK

Using Closer Clump Detection Protocol, Broadcasting Range Adjustment Protocol and Energy Efficient Based Clumping algorithm we have to design a Adhoc Network that control the following constraints such as Battery power Constraints , Network life time, end to end delay, throughput of network, packet delivery ratio etc. For increasing network life time it is necessary to consider all metrics rather than focusing on particular metric.

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