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A Review of Cluster Techniques for Efficient Work In MANET

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Abstract

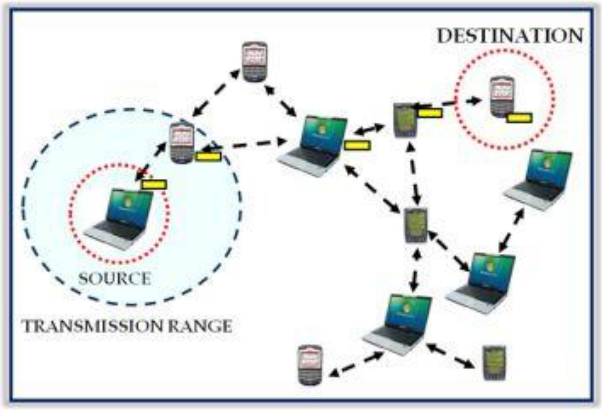
Mobile ad-hoc network is one of the emerging field of research where lots of work is done. Cluster formation is one of the most efficient method of communication. In this paper, we study about MANET application and infrastructure or cluster techniques.

Keywords: MANET, CM, CH, GN

Introduction

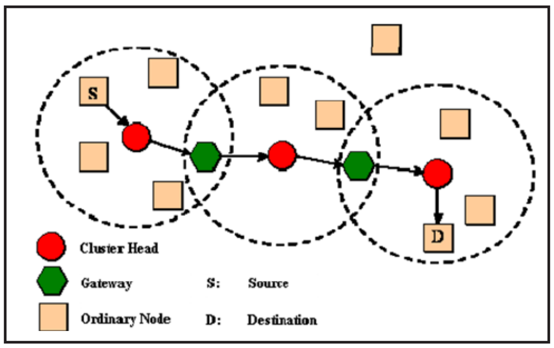
MANET's contribute self-deployable method of dissemination but conducts the challenge of energy efficiency, scalability, and mobility. MANET is a collection of intellect- contouring network of mobile gadgets; i.e. lacking of unmitigated infrastructure and might be coupled through the wireless links. Also we can say "MANET is an aggregation which contains mobile user which disseminates over adequately bandwidth constrained connectors". Because nodes is Mobile and sustains a Dynamic topology they may be randomly deployed in a network. In network topology, every apparatus entitled as a node and the essential connection between two nodes is known as link. A link is subsisting between the nodes when the nodes lie in the transmission range of each other [1].

Routing is a very important functionality of MANETs. The concept of routing is a set of procedures to ensure the establishment and maintenance of communication between the nodes. The autonomy of nodes is another important functionality of MANETs. The depletion of the energy of a node not only affects its ability to communicate but may squarely cause the network partitioning. The purpose of extending the life of the network cannot be completed if all mobile nodes are treated fairly [2].



Cluster

Clustering is a technique to divide a whole network into small and self-manageable entities called cluster. Cluster based routing comes under the implementation of a hierarchical routing approach in which the network is divided into subsets of nodes. Every cluster has many nodes which are named as: Cluster Head (CH), Cluster Member (CM) or ordinary node and Gateway Node (GN). Ordinary nodes send the packets to their cluster head that either distributes the packets inside the cluster, or forwards them to a gateway node to be delivered to the other clusters. Only gateways and cluster heads participate in the propagation of routing messages [3].



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Clustering in MANET

Dividing the whole network into some disjoint or overlapping group of mobile nodes, called clustering and the resulting groups of nodes known as cluster. There is a special node in each cluster, called cluster head (CH). Other nodes except CH are known as member node. Gateway node is the node through which two cluster head can communicate. Here are some Clustering Goals:

- Accomplish communication scalability for a large number of nodes and high mobility.
- Spatial reuse and coordination of assets.
- Expand system capacity.
- Reduce retransmissions and collisions.
- Equalization the utilization of assets in the network.
- Virtual communication backbone.
- Inter-cluster communication can be restricted to cluster-heads and cluster-gateways.
- Redesign and keep up cluster information just locally Minimize information stored and propagated in the network.

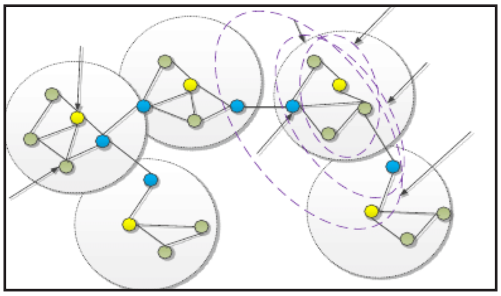
Advantages of Clustering are:

- Reusability: spatial reuse of resources at nodes.
- Simplification: of addressing.
- Stability and Localization: smaller and conceivably mode stabile sub-networks structures [4].

Cluster Approach for MANET

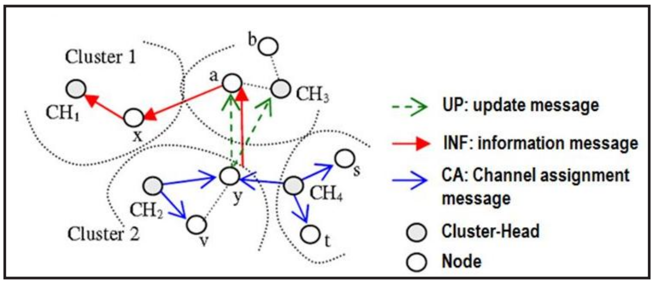
Clustering approach for MANET has been proven to be a promising technique for mimicking the operations of stationary infrastructure and resource management in multi hop wireless networks. Various clustering schemes have been proposed till the date. Such as: Lowest-ID, Highest-Degree, Distributed Clustering Algorithm, Weighted Clustering Algorithm (WCA) and Distributed Weighted Clustering Algorithm (DWCA).

Lowest-ID (LID): It was proposed by Baker and Ephremides. It is also known as Linked cluster Algorithm (LCA). In this algorithm, each node is assigned to unique ID. All nodes broadcast their ID to their 1-hop neighbors at regular interval. After that each node compares its own Id value with received IDs from their direct neighbors. A node declares itself as CH if it has the lowest ID value among its neighbor IDs. This approach concerns only with the lowest value of node ids which are arbitrarily assigned values without considering any other qualifications of a node for selection as a cluster-head. Since the value of node IDs do not change with respect to time, those with smaller IDs have more chances to become cluster-heads than nodes with larger IDs. Thus, shortcomings of lowest ID scheme is that certain nodes are prone to battery drainage due to serving as cluster-heads for longer time period, the packet delivery delay may become excessive, battery drainage, the selection of cluster heads has to be frequently updated because of high mobility of nodes etc.

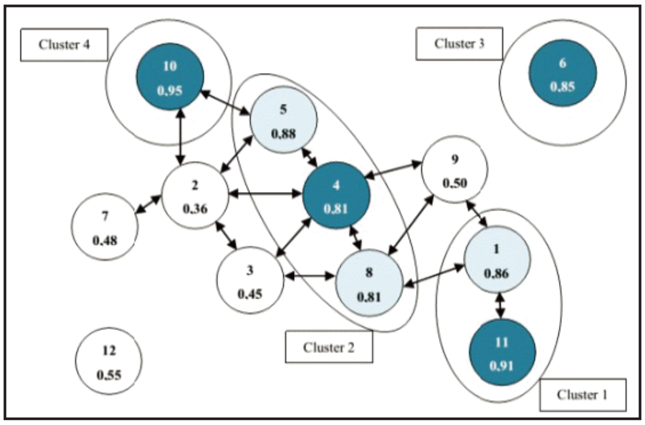


Highest-Degree (HD): It was proposed by Gerla and Parekh. It is also termed as connectivity-based clustering approach, which operates based on the value of node degree that is the number of neighboring nodes of a particular node. In this algorithm every node broadcast their ID in the same network. Based on the number of received IDs, each node calculates its degree value and the one who has the maximum degree value will be selected as cluster-head (CH). If two nodes or more have the same degree value then node with the lowest-ID is selected as the cluster head. In this approach, the number of cluster heads is relatively low in comparison with lowest ID approach. In addition, it also reduces value of packet delivery delay. However, the number of re-affiliations of CHs increases when the topology changes. All these shortcomings happen because this scheme does not have any restriction on the upper limit of the number of nodes inside a cluster.

Distributed Clustering Algorithm (DCA): It is an enhancement of lowest-ID algorithm. A real number above zero (a generic weight) is given to each node inside the network. Then each node broadcasts its weight value to its all neighbors. A node is selected for cluster head if its weight value is higher in comparison with all its neighbor weight values, otherwise, it joins one of the neighbor clusters. If multiple neighbor nodes have the same weight value, the node with lowest-ID will be appointed as the cluster head. This algorithm inherits the drawbacks of the Lowest-ID algorithm. In addition, The number of cluster heads generated at the end will be high in comparison with previous approaches, which degrades network performance.



Weighted Clustering Algorithm (WCA): This approach was proposed by M. Chatterjee. This algorithms obtains 1-hop diameter clusters with one cluster-head. The selection of the cluster-head depends on value of weight associated with each node. DWCA is extension of WCA approach to achieve distributed clustering and to enhance lifetime of the system. This algorithm operates in two different phases: cluster formation and cluster maintenance. This approach differs from WCA because it selects locally optimal cluster heads in a distributed way and involves power management at the cluster heads. DWCA adds a new metric called consumed battery power for calculating weight value during cluster formation. This approach provides better performance results than WCA in terms of the number of re-affiliations of Cluster heads, end to- end throughput and delay, total overheads generated during the clustering phases and longer life span of nodes [5].



Definitions

MANET can be described a simple undirected graph, where is the set of nodes, is the set of edges. According to the structure of the network topology, we can have the following definition:

Definition 1. Given that u and v are within the communication range, we have u,v $\in$E and the node is one hop neighbor to the other. If N(v) represents the neighbor set of node v, we have u $\in$ N(v). N(v)is also called node v's connectivity.

Definition 2. The distance of two nodes d(u,v) is the least hops between node u and node v A cluster C_i, C_i belong to V consists of a group of nodes, it has only one cluster head.

Definition 3. A domination set is the set of all clusters in a network. The cardinality is the number of clusters. If each cluster head is not neighbor to each other, the network is domination-independent.

Definition 4. The member set of a cluster head V_i is called Accepted Set ACC(V_i) The largest member number which a cluster head can accept is called Accept Threshold δ The number which a cluster head V_i can go on to accept is called availability AVI (V_i) [6].

Literature survey

Joydeep Kundu (2015) et al present that trust management scheme is efficient in terms of protection against the deceptive behaviour of malicious cluster-members (CMs) and cluster-heads (CHs) both at the intra and inter-cluster levels in MANET [7].

Avita Katal (2013) et al present that performed to select a Super Cluster Head. A node is selected as a Super Cluster Head only if it is having maximum battery power and it is not a Cluster Head. The technique used chooses the best of the nodes to become Cluster Head and Super Cluster Head. This technique seems to increase network life time also because of the slow dissipation of the energy [8].

Kanwaljeet Kaur (2015) et al present that a WSEEC (Weightage based Secure Energy Efficient Clustering) algorithmic approach towards energy efficient clustering and security of nodes. The aim of this algorithm is to build secure and energy efficient cluster head. Where rely value of each node is calculated to know the behavior of the node. The performance of proposed WSEEC algorithm is compared with WCA under five metric such as a Network life time, Energy consumption, throughput, delay and packet delivery ratio [9].

Shoma Nakahara (2014) et al, evaluate the proposed scheme through simulation experiments and confirm the effectiveness of the proposed scheme in terms of the data packet delivery ratio [10].

Mohamed DY ABI (2014) et al, gives major improvements regarding the number and the performance of elected cluster heads. Analysis and simulation results are used to show the performance of our algorithm, compared with other clustering algorithms in literature [11].

Saleha Mubarak AlMheiri (2015) et al present that Clustering is a technique to group the nodes that have similarities according to some criteria together. Each algorithm has specific criteria that play a critical role in building a stable cluster. Through this paper, several clustering algorithms are presented and classified according to different categories. Also, main drawbacks in each algorithm are highlighted in order to help the researchers for further improvements and developments [12].

Anju J (2014) et al present that wormhole attack launched by exploiting AODV protocol in MANET, is detected and eliminated in two phases. The preliminary phase in the process of identifying wormhole attack is done, based on timing analysis and hop count. After suspecting the attack, a Clustering based approach is used to confirm the presence of attack, and also to identify the attacker nodes. The entire network is divided into different clusters and each cluster will have a Cluster Head, which controls all the nodes in the cluster and plays the role of a controlling authority in MANET [13].

Amar Amouri (2015) et al present that employs an hierarchical configuration that avoids using a clustering algorithm and, instead, sequentially activates the promiscuity (ability to sniff all packets transmitted by nodes within radio range) of the node based on its location in the network. The node in this case acts as a pseudo cluster head (PCH) that collects data from its neighboring nodes in each quadrant in the field and then uses this information to calculate an anomaly index (AI) in each quadrant. The mechanism uses a C4.5 decision tree to learn the network behavior under blackhole attack and is able to recognize blackhole attacks with up to 97% accuracy. The presented approach is twofold - it is energy efficient and has a high degree of intrusion detection with low overhead [14].

Poonam Thakur (2015) et al present that Adhoc On Demand Distance Vector (AODV) is proposed, since for the existing algorithms control overhead is very high which consumes a lot of available bandwidth . In the future performance evaluation of the proposed technique can be done and the results thus obtained can be compared with the existing algorithms. We hope that control packet overhead will be less in case of proposed algorithm [15].

R. Vintoh Kumar (2014) et al present that Certification Authority as one parameter and RSSI as the other parameter. The RSSI is used to form the cluster and to elect the cluster head. The CA's responsibility is given to the CH. Whenever huge variations occur in RSSI on neighbour's entry and exit behaviour, the Certification Authority comes into play. The CA checks the certification of a node. If it is not valid, its certificate is revoked otherwise it is free to communicate in the network [16].

Sapna B Kulkarni (2015) et al present that design Node connectivity, Energy and Bandwidth Aware Clustering Routing Algorithm. An efficient ENB cluster head selection algorithm based on the combination of important matrices Residual Energy (E), Node connectivity (C) and Available Bandwidth (B) is considered for election of the cluster head efficiently. The multimedia stream splits into multiple sub-streams prior to transmission using Top-N rule selection approach algorithm [17].

Problem Statement

In existing work given solution work only active attack if passive attacks are deploy in network then there is no possibility to find attacker node, if short term attack like gray hole attack deploy in network then find out misbehaving is difficult. in existing work no definition of thresh hold value for checking throughput and PDR value.

Propose Work

In our propose work first we modified the AODV working functionality in which all source node store the information of each available path, divide the data into packet and wait for acknowledgment. If ack not come from any path source node mark this path for observation and send all the node id of this path to intrusion detection system. And ids observe the behavior of these nodes and after observation it broadcast the information about these nodes. Passive attack condition data analyze by attacker and send to destination for detect and prevent network by passive attacks all node have their neighbors information, in passive condition ids analyze the common nodes in all paths which is mostly use in transmission of data between source to destination and then ask neighbor of their nodes and on the basis of their reply ids detect malicious node.

Conclusion

A MANET (mobile adhoc network) is an independent approach of cellular routers attached through wireless links, now not necessarily with any aid from the existing infrastructure or further kind of fixed stations, therefore this provide extremely high flexibility and they communicate rapidly and impulsively. This paper presents cluster based MANET. In this paper present various cluster on MANET discussed and analyzed in the paper along literature survey.

References

[1] Gupta, S. K., Khatri, P., & Agrawal, P. (2014). Cost based scalable clustering in MANET. *6th International Conference on Computational Intelligence and Communication Networks IEEE*, (pp. 439-443).

[2] Choukri, A., Habbani, A., & Koutbi, M. E. (2014). An Energy efficient clustering algorithm for MANETs. *International Conference on Multimedia Computing and Systems*.

[3] Alinci, M., Spaho, E., Lala, A., & Kolici, V. (2015). Clustering Algorithms in MANETs: A review. *9th International Conference on Complex, Intelligent, and Software Intensive Systems IEEE*, (pp. 330-335).

[4] Kar, P., Kar, P., & Barma, M. K. D. (2016). Forecast weighted clustering in MANET. *12th International Multi-Conference on Information Processing-2016 (IMCIP-2016), Procedia Computer Science,* 89, (253-260).

[5] Dalasaniya, K., & Dutta, N. (2014). An efficient cluster management mechanism for MANETs. *IEEE International Conference on Computational Intelligence and Computing Research*.

[6] Zhou, H., & Zhang, J., (2015). An efficient clustering algorithm for MANET based on weighted parameters. *8th International Symposium on Computational Intelligence and Design IEEE*, (pp. 145-148).

[7] Kundu, J., Majumder, K., & De, D. (2015). Design and analysis of an efficient trust management scheme for clustered based MANET using Bayesian method. *IEEE Sponsored 2nd International Conference on Electronics and Communication System (ICECS 2015),* (pp. 60- 65).

[8] Katal, A., Wazid, M., Sachan, R. S., Singh, D. P., & Goudar, R. H. (2013). Effective clustering technique for selecting cluster heads and super cluster head in MANET. *International Conference on Machine Intelligence Research and Advancement IEEE,* (pp. 1-6).

[9] Kaur, K., Singh, J., & Himani. (2015). Weightage based Secure Energy Efficient Clustering Algorithm in MANET. *International Conference on Advances in Computing, Communications and Informatics (ICACCI) IEEE*, (pp. 1006- 1012).

[10] Nakahara, S., Ohta, T., & Kakuda, Y. (2014). A routing scheme based on autonomous clustering and P2P overlay network in MANETs. *IEEE International Conference on Ubiquitous Intelligence and Co.,* (pp. 514-520).

[11] Dyabi, M., Hajami, A., & Allali, H. (2014). An enhanced MANETs clustering algorithm based on node performances. *IEEE International Conference on Multimedia Computing and Systems*.

[12] AlMheiri, S. M., & AlQamzi, H. S. (2015). MANETs and VANETs clustering algorithms: A Survey. *IEEE Proceedings of the 8th IEEE GCC Conference and Exhibition*, Muscat, Oman, 1-4 February.

[13] Anju, J. & Sminesh, C. N. (2014). An improved clustering-based approach for wormhole attack detection in MANET. *3rd International Conference on Eco-friendly Computing and Communication Systems IEEE*, (pp. 149-154).

[14] Amouri, A., Jaimes, L. G., Manthena, R., Morgera, S. D., & Vergara-Laurens, I. J. (2015). A simple scheme for pseudo clustering algorithm for cross layer intrusion detection in MANET. *7th IEEE Latin-American Conference on Communications*.

[15] Thakur, P., & Ganpati, A. (2015). Cluster based route discovery technique for routing protocol in MANET. *International Conference on Green Computing and Internet of Things* (ICGCIoT), (pp. 622-626).

[16] Kumar, R. V., Ramesh, P., & Rauf, H. A. (2014). Cluster based enhanced Sybil attack detection in MANET through integration of RSSI and CRL. *International Conference on Recent Trends in Information Technology IEEE*.

[17] Kulkarni, S. B., & Yuvaraju, B. N. (2015). Node connectivity, energy and bandwidth aware clustering routing algorithm for real-time traffic multicasting in MANET. *IEEE International Advance Computing Conference (IACC),* (pp. 760- 763).