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Research paper

CBPPRS: Cluster Based Privacy Preserving Routing Selection in Wireless Networks

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Abstract

The In wireless mobile ad hoc network, each node / junction is proficient of transfer message (information) with dynamism without constraint of any permanent infrastructure environment. Movable nodes commonly progress inside or outside from the entire network dynamically, building network topology unbalanced in mobile ad-hoc network (MANET). In a privacy preserving network group, cluster head is dependable for communication with associates in a cluster which consumes additional battery (energy) supremacy in evaluation to cluster members in a cluster. As a message transmission inside and outside cluster as a result, it becomes an enormously testing job to maintain stability in network. In this paper aims to present a cluster based privacy preserving routing protocol selection algorithm in inside and outside cluster using NS (Network Simulator) 2.34 Framework. The proposed routing protocol selection based Cluster head selection formation operates exclusively based on source routing and on-demand process, it has been selected as the routing protocol to be executed and tested for ad hoc network application characterized by a source on-demand message conversation between nodes in a portable ad hoc network

Keywords: *Cluster, Cluster Head, Gateway, Privacy Preserving, Wireless Networks.*

1. Introduction

A MANET (Mobile Ad hoc Network) consists of an amount of mobile nodes equipped among a transmitter and a receiver. MANET was envisioned to generate a network dynamically on-the-fly without relying on any wired infrastructure. That is why; they are besides called "communications less network". Unlike the infrastructure-based networks such as a cellular network, all the components of an ad hoc network are highly mobile and outstanding to this mobility, the topology of the network changes dynamically (Jayaprakash et al., 2017). The base station in cellular networks is analogous to the cluster head in ad hoc networks; however, the difference is that base stations are stationary while the cluster head themselves are also mobile. Fixed wireless networks usually exist in a form of a master slave relationship. However, MANETs do not share this characteristic. Nodes rely solely on each other to established communication links and act as routers to convey data packets between source and destination pairs. Since the data packet may need to travel from a starting node (source) to a target node (destination) through a cluster of intermediate nodes, yet another name for ad hoc networks is "multi-hop networks".

Clustering is the progression of separating the network into interconnected substructures, named clusters (S Pathak et al., 2014). In a clustered network, nodes are divided into distinct logical set (clusters), which is allocated geographically adjacent to each other. A distinctive cluster structure is revealed in Figure 1.

As depicted, nodes are divided into logic groups (within the dotted lines) according to the rules of the clustering scheme. "Nodes may be assigned a different role or function, such as cluster head, gateway or cluster member (M Chatterjee et al., 2004) & (P Jianli et al., 2008). A cluster head typically serves as a coordinator for its cluster, performing intra-cluster management functions and data-forwarding".

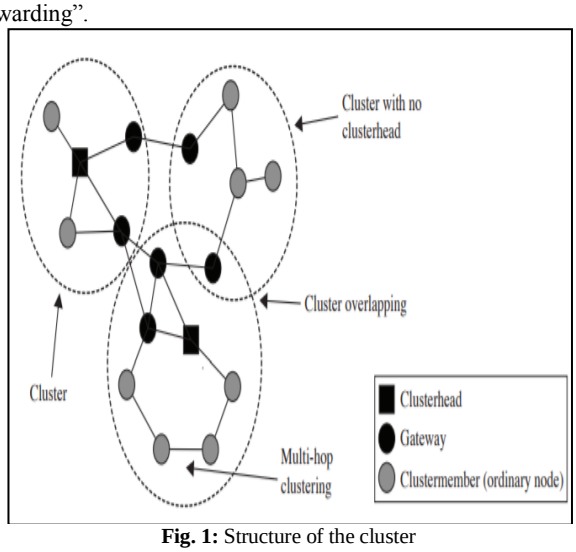

Fig. 1: Structure of the cluster

A gateway is a node with inter-group mechanism links, which can forward information between clusters. There are clustering schemes that support cluster overlapping. In other words, two distinct clusters may share nodes. In this case, gateway nodes may be assigned to more than one cluster. Finally, cluster members, also referred as ordinary nodes, do not possess special cluster maintenance functions; they simply belong to a cluster.

A clustered (group) topology in large network enables efficient performance. The cluster structure provides several benefits, some of which mentioned below.

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1.1 Reduced Topology Information

Due to the number of nodes or junctions inside of a cluster being lesser than the number of nodes of the whole network, the clustering process eases the aggregation of topology information. As a result, each node required to stock up a reduced portion of the complete network routing in rank.

1.2 Routing Efficiency

In a flat architecture all node bears identical responsibility to proceed as a router for forwarding packets. The great amount of message flooding inherent to path discovery reduces the routing efficiency (W Bednarczyket al., 2013). A clustered structure improves routing efficiency and makes the path discovery easier.

1.3 Efficiency and Stability

In the perspective of a mobile node, the network appears smaller. Thus, when a mobile node disconnects or switches to another cluster, only the nodes residing in the corresponding clusters are required to vary their fact structures. There are further advantages that are transversal to the mentioned benefits. As a product of clustering, the communication bandwidth, energy consumption, throughput and scalability are improved.

The aim of this work is to develop a cluster based privacy preserving routing protocol in MANET framework is to effectively partitioning inside and outside cluster message transmission in secure manner. In this paper, we will discuss the routing process of routing topology deployment and initial cluster head formation in privacy manner.

The rest of the paper is ordered as follows: Literature Review detailed is in Section 2, Section 3 - Cluster formation process and conclusion in Section 4 respectively.

2. Literature Review

(W You et al., 2015) proposed that the end-to-end model, which was calculated for individual data transmission in the before time period of Internet, is reasoning difficulties universally in currently content based web services. Accordingly, Information Centric Network (ICN) is projected to resolve these problems. As the majority permanent clean-slate advance for subsequently generation Internet, ICN has concerned greatly consideration from network researchers in the past little years. This review focused on the present development of the research work in ICN. It examined different key features such as naming and routing systems, in-network caching strategies, etc., and highlights the advantage of implementing ICN, open research problems and new interests in this domain.

(M Ulema, JM Nogueira, B Kozbe, 2006) projected that "A wireless sensor network consists of great information of sensors, which are tiny, low-cost, low-power radio procedure committed to performing confident functions such as gathering different ecological data and transfer them to communications processing channel nodes. The field of wireless sensor networking is too in advance better interest among not just researchers but also mixed groups such as environmental, public security, military and medicine. This tutorial creates with a summary of the wireless sensor networks. An assessment of the present technologies used for these types of wireless methods of network. The focus is on the architectural concern such as routing, topology and protocols. Lastly, the network executive issues connected to wireless sensor networks are discussed. The tutorial concludes with a conversation of the open research problems in this area."

(C Suchismita & R Santanu Kumar 2009) projected "Single-hop clustering method accepts the simple system to create the rational panel of the dynamic network where the network topology modifies continuously resultant an unbalanced clustering. In this paper creates a complete survey of various bench-mark single-hop clustering algorithms to recognize the research developments in this area. The literature presents the logic of cluster formation for special algorithms in completes linked cluster architecture and an exhaustive simulation review of their performance on the cluster protection features such as frequency of cluster reelection, cluster density, frequency of cluster modifies by the mobile nodes and the granularity of cluster heads. This paper must assist the researchers as well as practitioners in preferring an appropriate clustering algorithm on the source of their configuration and maintenance overhead, prior to every routing method be accepted in the mobile ad hoc network."

(JY Yu & PHJ Chong 2005) discovered that "Clustering is a significant research subject for portable ad hoc networks (MANETs) since clustering creates it promising to assure a basic level of system presentation, such as accuracy and delay, in the occasion of mobility and a huge number of mobile terminals. A huge variety of approaches for ad hoc clustering have been obtainable, whereby special approaches normally focus on different performance metrics. This article presented a complete review of recently proposed clustering algorithms, which to classify based on their ideas. This survey provides descriptions of the methods, evaluations of their performance and rate, and discussions of advantages and disadvantages of every clustering method. With this item, readers can have an additional through and fragile accepting of ad hoc clustering and the research developments in this area."

(J-H Ryu et al., 2001) stated that "Distributed heuristic clustering methods are proposed that reduce the necessary broadcast power in two-tiered mobile ad hoc networks. Both methods can be realizing and executed in real time and can be assumed for periodic or event-driven cluster reconfiguration. Method presentation is simulated and evaluated with optimum configurations based on the signify spread power and the describe drop velocity as performance measures."

(A Ephremides et al., 1987) future that "Network survivability is attained during the use of scattered network control and rate of recurrence hopping spread-spectrum indicating. The authors demonstrated how the implementation of the completely distributed Linked Cluster Algorithm can allow a network to reconfigure itself when it is concerned by connectivity modifications such as that resultant from jamming. Further resistance besides jamming is presented by frequency hopping, which directs naturally to the use of code division multiple access (CDMA) methods that allow the simultaneous successful transmission by some users. Distributed algorithms that develop CDMA belongings have been developed to plan contention-free transmissions for greatly of the channel access in this network. Contention-based channel access protocols can also be executed in conjunction with the Linked Cluster network configuration. The design concept obtainable in this paper provides a high amount of survivability and flexibility, to contain changing environmental circumstances and user strain."

(CH Liu et al., 2015) designed that "Energy control in a digital handset is basically implemented in a separate fashion, and frequently, such a Discrete Power Control (DPC) system is suboptimal. In this paper, authors illustrated initial show that in a Poison-distributed ad hoc network, if DPC is correctly considered with a confident condition satisfied, it can strictly work improved than no power control (i.e., users employ the same constant power) in conditions of standard signal-to-interference ratio, outage chance, and spatial reuse. This ideology indicates us to have an N-layer of DPC design proposal in a wireless mobile clustered ad hoc network, where source and receivers in globular clusters are distinguish by a Poisson cluster process on the surface. The cluster of every transmitter is tessellated into N-layer annuli with transmit power Pi accepted if the intended receiver is positioned at the ith - layer."

(F Al-Kalani et al., 2008) proposed that "In mobile network, the clustering method varied due to the mobility of the mobile nodes some time in any direction. That reasons the separations of the network or the combination of mobile nodes. Some presented centralized or globalized algorithm have been proposed for clustering method, in a way that no single node becomes remote and no cluster becomes congested. A particular node called head cluster or organizer is chosen, has the position to arrange the distribution of

nodes in clusters. The authors proposed a spread clustering and head (leader) selection mechanism for Ad-Hoc mobile networks, in which the head is a mobile node. The experimental results demonstrate that, in the case of leader mobility the time required to choose a new leader is less significant than the time desirable an important topological modify in the network is occurs."
(R Pandi Selvam et al., 2011) stated that "In ad-hoc networks, clustering is a significant and recognizable method to separate the huge network into some sub networks. According to the dynamic topology the clustering is believes as complex process in ad hoc networks. In this paper, they have determined to plan a new value based clustering algorithm to progress the presentation in this wireless communication technology. Execution experiments are performed to review the effective performance of the algorithm in the broadcast range, quantity of mobile nodes and maximum displacement."
(C Chiang et.al, 1997) noted that "A cluster head-token communications for multi-hop, mobile wireless networks has been considered. Conventional routing algorithms in wire line networks are not reasonable for transportable wireless environment right to the active change in link connectivity. To increase the superior performance for clustered multi-hop, mobile wireless networks, routing should take into account radio channel access, channel reservation and code forecast. In this paper, authors proposed various heuristic routing methods for clustered multi-hop, mobile wireless networks. A message delay development up to four fold has been experimental in the simulations evaluated with shortest-path method, making multimedia traffic feasible. A means of communication channel structure has been incorporated on the way to examine the impact of channel fading on the protocols."
(Jayaprakash R & Radha B 2017) quoted that CBPR in Mobile network using Privacy Preservation manner including inside and outside cluster has provided new direction for to develop and improved techniques for wireless ad-hoc network.

3. Cluster Formatiion Rotuing Process

The cluster formation in privacy preserving routing process considers the clustering network region is alienated on several polygons, each called a cluster. All clusters have a center with coordinates defined as cluster location that could be used as cluster identity (ID). A node close to the cluster center is chosen as cluster head (CH). CH directs the positions of nodes fit in to that cluster. While moving inside a cluster, a node requests to broadcast its position only to the nodes that reside in that cluster. A node's cluster location is simplified when it leaves its own cluster and goes into an additional cluster. "Cluster based routing is performed by using two steps. The initial pace is inclusive dynamic routing in which messages are moved from individual group to a different group that is nearer to the target depending on cluster locations. Communications are promoted based on right-hand strategy in case of dead end cluster. The next step is called privacy preserving cluster based steering in which datagram's are routed connecting clusters". The figure 2 describes the cluster based privacy preserving routing protocol flow.

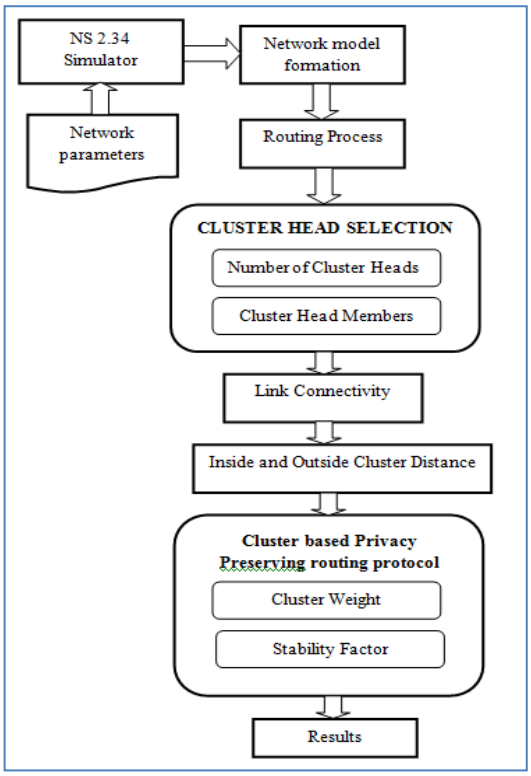

Fig. 2: Cluster based privacy preserving routing protocol flow

3.1 Network Formation

In network formation process is evaluated in graph formation. As a graph denoted as $G = (N, L)$, where N represents the set of mobile nodes and L represents the group of Links/lines/edges among the nodes. In this model consists of n amount of heterogeneous mobile nodes randomly arranged in the simulation tool environment. Every node has the unique identity (ID) and is prepared with Omni-directional projection. It is implicit that nodes are position alert and can compute their qualified distance to their neighboring nodes. Let $\mathcal{P}_{max}(k)$ be the maximum transmission power, let $\mathcal{P}_{min}(k)$ be the minimum transmission power, and let P_k be the transmission power of a mobile node $k \in L$. To begin with mobile nodes broadcast with maximum power $\mathcal{P}_{max}$.
In this proposed scheme the network formation is assumed that transmission power (k) can be regulated linking the maximum and minimum value; that is, $\mathcal{P}_{min}(k) \leq P(k) \leq \mathcal{P}_{max}(k)$. Let P_{kv} be the minimum transmission power essential to communicate between nodes k and v, which can be calculated as $P_{kv} = \mathcal{D}ist^{\beta} + C$, where $\mathcal{D}ist$ is the Euclidean remoteness between k and v, β is the path loss exponent, where $2 \leq \beta \leq 4$, and C is a constant value. Let Graph $G = (N, L)$ be a primary topology of the network and let $G' = (N, L')$ be the topology, achieved when the transmission power control method is applied at mobile nodes.

3.2 Routing Process

The routing process is completely based on-demand of ad hoc network routing protocol composed of two parts: Route Discovery (Identity) and Route Maintenance (Preservation).

- Route Discovery is mainly used to search (find) a path; this node is known as the originator of the Route Discovery, and the destination of the message is recognized as the Discovery's object.
- Route Maintenance is the method by which the node conveys a message alongside a particular path to various destinations identifies if that path has broken down, for example since two nodes in it have stimulated moreover separately.

Routing process in mobility clustering is complicated as an end product of the self motivated environment of association topology

and their resource conditions. The problem of connection consistency in mobile ad hoc networks is a major concern to broadcast packets throughout network layouts. Direction-finding process in multi-hop wireless networks via the shortest-path process is not relevant situation to build fine superiority routes, because least amount hop count routing frequently selects paths that have extensively a lesser amount of capacity than the finest routes in the network.

3.3 Cluster Based Privacy Preserving Routing Selection

The cluster head selection is attractive that a cluster head has the highest number of single-hop neighbor's node within its broadcast range and least amount rate of nodes moving away of its communication range. "Since during Cluster Head formation/reformation, it is not easy to compute the number of junctions moving into present neighborhood group in later and their leave-taking rate after moving in. As a result, just the number of available junctions within the current cluster is considered at that time of Cluster Head setting up or else updating. The proposed method demonstrate the amount of single-hop neighbors when conducting the cluster creation/recreation as N and the rate of nodes leaving as v Maximizing N can decrease the average number of clusters in the network, which can save energy and reduce the rate of associate member interchanges between various cluster groups. Minimizing N results in the links connecting a cluster head and the cluster elements to be high stable". In other words, the cluster construction is more resilient to the moment of nodes, which can decrease the number of manage packet transparency, enhance the routing constancy and diminish the broadcast delay.

Cluster Based Privacy Preserving Routing Selection considers the collection of Cluster heads (CH) in a mobile ado network of n junctions/nodes such that all nodes in this network are within distance h hops of a CH, for a known DEFINED - VALUE. In the proposed CHS representation flow described in figure 3, the Cluster duration indicates the instance from the position of node is chosen as Cluster head until the position of a node modifies its condition to standard node. It should be noted that the Cluster generation is needy on mobility problems; the Cluster duration in stable network depends on link reliability. In the simulation model (using NS2.34 Tool) a Clustering packets is sent every 2 seconds. Thus, a neighbor node is reserved in the neighbor table for $2 * CNT\ R$ seconds and discarded if there is no additional Clustering communication received. Primarily, the Statement History (SH) for all mobile nodes has been calculated as empty or ≥ 1. Algorithm 1 represents the Cluster head(s) identifying progress as well as a flow diagram has been revealed in figure 3.

From equation (1) DEFINE - VALUE can be further calculated by;

$$DV_{ij} = \frac{\sum_{n=i}^{m} DV_{ij}}{SH} \qquad eqn.(1)$$

Where $i, j \in$ mobile nodes (points); DV_{ij} is node i's DEFINED - VALUE for node/junction j. Appropriate lively changes in the topology of system, the Cluster (group) formation is indentified from every time to time.

Algorithm 1: Cluster Based Privacy Preserving Routing Selection

Initialize $CH_{cur} \leftarrow 0$; $CH_{prev} \leftarrow 0$; $Time_{prev} \leftarrow 0$; $Current() \leftarrow 0$;
Step 1: Time – $OUT_{loop} \leftarrow 2$
Step 2: equation (1) DEFINED-VALUE can be further evaluated
$D_{nij}(t_2) = D_{nij}(t_1) * \exp[-(D_{nij}(t_1)\Delta t)]^{2k}$
Where $\Delta t = t_2 - t_1$ and k is an int value, i.e. $k \geq 1$
Step 3: while $Time_{prev} \leq Current() ||$ DEFINE – VALUE(CH_{prev}) ≤ 1 = true **do** CH_{prev} remains as Cluster head
End while
Step 4: if DEFINE – VALUE(CH_{prev}) = DEFINE – VALUE(CH_{cur}) && $SH(CH_{pre})$ = SH(CH_{cur}) **then**
Both CH_{prev} and CH_{cur} stay as cluster heads
Else
Choose latest Cluster (group) Heads
End if

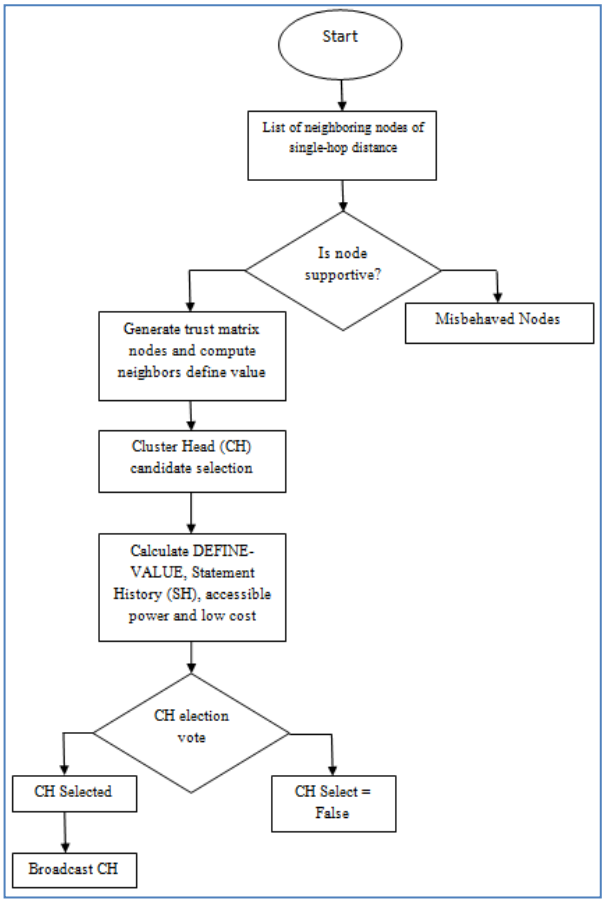

Fig. 3: Flow diagram - To identify the cluster head

Table 1

The simulation representation considers 51 nodes in Cluster Based Privacy Preserving Routing Selection network, with nodes (vertex) randomly deployed in a 300 m x 300 m simulation area. The simulation parameters is given below,

Parameters	Symbol	Value
Mobile Nodes	MN	5-50 in steps of 10
Simulation Area	Width x Column	300 x 300
Transmission Range	TR	5-50 in steps of 10
Distributed Weights	D_{w1}, D_{w2}, D_{w3}, …, D_{wn}	(0.1, 0.04, 0.05, 0.2, 0.5)
Node Energy	E_{node}	100Joules
Boosting Energy	E_{boost}	100J/bit/m^2

4. Conclusion

In this paper reviewed and analyzed the cluster based privacy preserving routing selection methodology algorithm for portable ad hoc networks on the strength of linkage and cluster head selection formation. Necessary factors such as node speed, relative energy of the node, remaining energy and weights are well-thought-out to establish an appropriate clustering inform period and choose head of cluster. To make a substitution among the corresponding issues with no weights combination needed, this paper proposed a cluster weight in privacy preserving manner routing protocol selection algorithm for cluster head selection technique. These constraints are used to progress and enhanced cluster head constancy, cutback in the amount of clusters in the network, and civilizing the energy effectiveness. Meanwhile, the

proposed system build a link generation methodology to calculate approximately the generation of every connection and proposed a highest group head revised space (edges generation) representation to recognize the grouping update occurrence.

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