

Study of major issues of cluster-head gateway switch routing in MANET

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Abstract : This paper proposes the major issues of cluster-head gateway switch routing protocol. When the nodes are mobile in a cluster then the problem of selection of cluster-head arises, hence the key objective is to enhance the optimum cluster head selection when the cluster head is mobile along with the nodes. This paper provides the different Networking Scenario of protocols and their basic overview about the different techniques that are utilized for further multipath utilities.

IndexTerms - MANET, Routing, Cluster head and WSN.

I. INTRODUCTION

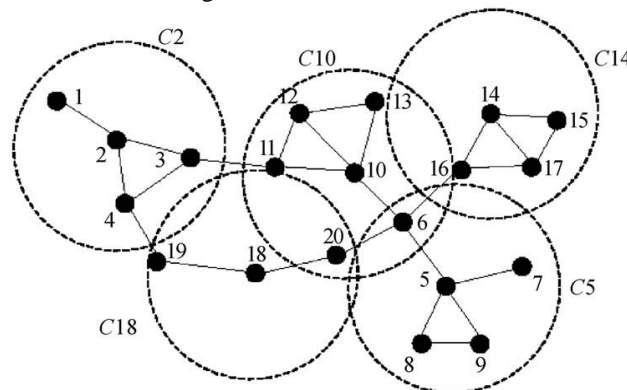
MANET is a group of nodes that can communicate with each other and can move freely using the wireless devices. The Vehicular Ad-Hoc network (VANET) is a network setting which pursue the idea of ubiquitous computing. In VANET vehicles appointed with wireless communication technologies acts like mobile nodes going on the road before long and this revolutionize the idea of travelling Mobile ad-hoc networks (MANETs) and wireless sensor networks (WSNs). Although WSN a close relative to MANET but differs in many aspects. Recently multipath has drawn an extensive attention in MANETs and WSNs. In MANETs/VANETs/WSNs network the scattered nodes make the multipath routing technique to deal with the repeated topological changes [1]. Efforts have been made to improve the data reliability, balancing the traffic load with minimum power consumption without delay.

1.1 Mobile Ad-hoc Network(MANET)

MANET is a self directed infrastructure less network where more than two mobile nodes can share data. Source mobile node (S) send data to destination mobile node (D), if they are in the coverage of transmission range can directly communicate to each other else intermediate mobile node relay the data from source to destination. In this mobile node can join and leave the network dynamically as the physical network changes frequently [1]. Battery power of device is also important aspect, because depletion of battery power may affect the lifetime of the node. The node movement differ for the mobile nodes, the topology also depend on the speed and the direction of the host. The network routing in MANET is a challenging issue due to dynamic nature of the topology. The propagation of data to destination through a single path is not sufficient. Therefore multipath routing comes into existence to overcome this problem.

The success of the MANET communication depends upon the involvement of the mobile nodes. MANET architecture leads to implicit weakness and a variety of the attacks. The dynamic nature of the MANET network makes it highly susceptible to various types of link attacks. For the secure networking it ensures confidentiality, availability, authenticity and integrity. For the MANET environment the available security solutions are ineffective and inefficient. As the transmission take place in the open medium make it more vulnerable to security attacks. The effect of the various attacks can be reduced in the presence of the secure protocol. Ad-hoc network dynamically established connection between independent mobile users. Applications are: emergency /rescue operations, disaster relief efforts, military networks, conference or campus networks, car networks, personal network etc.

Figure-1 Cluster of nodes.

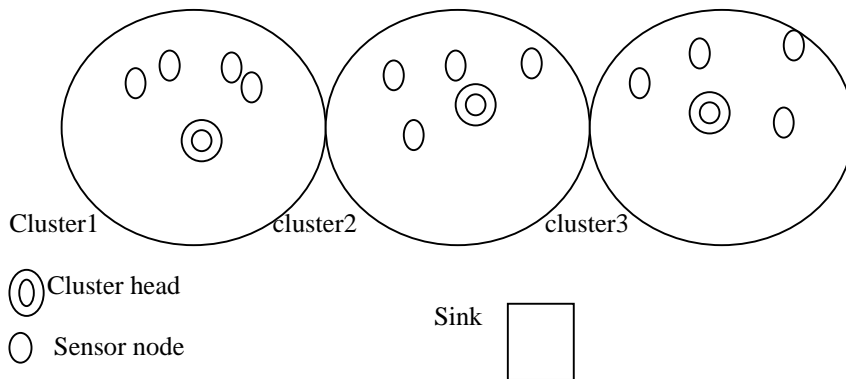


1.2 Wireless Sensor Network(WSN)

New coming technology is Wireless Sensor Network with quality of service provisioning recently focused by many researchers, established a path from the source and the destination while considering all the QoS parameter when the network is overloaded with the data. Although there is no guarantee that the data will be reached to the destination because the transmission range of the nodes in the wireless network is limited hence required the intermediate node to relay the data from the source to the destination. At present most of the routing protocols whether single path or multi path routing protocols in wireless sensor network, have focused on finding a path connecting source node and

the destination node considering the current traffic and the QoS of data transmission. WSN works where wired connection is impossible [2]. Wireless sensor nodes dwell on sensor such as magnetic, thermal, visual, seismic, infrared and the radar etc, which are capable to monitor a wide variety of physical and environmental conditions. The structure of WSN is built from a few nodes to several hundreds or even thousands nodes. It is the array of sensor in case of multiple data collection. These nodes are sensing the network process and relay the information of the targeting environments.

Figure-2 wireless sensor network



1.3 Vehicular Ad-hoc network(VANET)

The Vehicular Ad-hoc Network is a communication abstract which allows communication between the moving vehicles with high speed on roads. This has brought a new challenge to develop many applications such as traffic management, traffic engineering, information broadcasting to avoid dangerous situations and other user applications. The communication between vehicles for guiding, safety and handling emergency situation is the core concept of the (VANETs) [3]. The routing protocol route the data packets between the vehicles. Today's world is fast and completely based on speed and machine especially on road it's like a battlefield. VANET is a new network setting that follows the idea of ubiquitous computing. Now a day's vehicles are fitted with the wireless technology devices it's like mobile nodes are travelling on the roads.

II. RELATED WORK

Routing issues: Many routing protocols for ad-hoc network are available, but the designing of the protocols for the wireless network is still an active area. The optimal routing protocols for MANETs/WSNs/VANETs must have the following features:

- **Metrics Calculation:** For selecting the optimal path, the existent routing protocols use minimum hop-count as a performance metric.
- **Scalability:** Established a routing path in a large wireless network may take a longer time. Therefore it is require a scalable routing in wireless network.
- **Robustness:** The network service should be interruption free as its expectation to be sturdy to link failure or congestion.

Routing Protocol: This explains the key understanding about the different kinds of the routing protocols which provide the effective selection during the communication scenarios. Communication take place over the wireless network is called a routing. Guiding of the data packets from one node to the other nodes is a challenging task. As node act as a transceiver with no central coordinator has to manage routing decision by its own. So to look over the routing protocol is required [4]. There are many routing protocols invented for MANETs and it's classification is as follows _

- A Proactive or Table Driven Routing Protocols
- B Reactive or on Demand Routing Protocols
- C Hybrid Routing Protocols

A.Proactive Routing Protocols

In this each node maintain a record to the destination and periodically update its route by analyzing the topology transmission from other node.. As the topology of the network change the records are updated of the respective node. These network protocols maintain distinct number of routing tables which are changeable from protocol to protocol. Example: Optimize Link State Routing Protocol (OLSR), Destination Sequenced Distance Vector (DSDV).

Destination sequenced Distance Vector Protocol (DSDV): A distinction of the Bellman – Ford algorithm is implemented in the RIP (Routing Information Protocol) which is modified for self configuring networks. Every node maintains individual routing information in the routing table about the network topology and cost of the link between the nodes. The DSDV protocols require each and every mobile node to publicize their own routing table to all of its current neighbors [4]. Entries can vary over time due to presence of mobile nodes. The route advertisement must be made when there is any change in the neighborhood. All mobile nodes agree to forward the route advertisement messages to other nodes. The route selection is done based on the three steps

- a. The update information is compared to its own routing table.
- b. Selecting a route with higher destination sequence number
- c. Selecting a route with better metric when sequence numbers are equal.

Optimized Link State Protocol (OLSP): OLSP is an optimization of the pure link state algorithm, uses the concept of Multi Point Relays (MPR) for forwarding control traffic, intended for diffusion in the entire network. The MRP set is selected so that is covers all the nodes that are two hops away. Due to the proactive nature, OLSR periodically exchanges messages like hello messages and the Topology Control (TC)

messages only through its MPR [6]. The parameters used by OLSR for controlling the protocol overheads are hello-interval parameter, TC interval parameter, MRP coverage parameter and TC redundancy parameter. It maintains multipoint relays (MPRs) for minimizing the flooding by assigning the links of neighbors within its MRPs rather than its links.

Pros: Only small subnet of the link should be declared. Provide certain parameters to control the overhead.

Cons: It does not provide any security as other protocols provide. This limits the scalability.

Cluster-head Switch Gateway Routing Protocol (CSGR)

It is a table driven based routing protocol. Mobile nodes are grouped into clusters a hierarchical network topology while some protocols are flat topologies. In this mobile nodes are grouped into clusters. This grouping may be based on a number of criteria but most commonly they are based on either location or functionality [8]. The cluster boundary is based on transmission range of the clusters leaders known as cluster Head (CH).

Formation of Cluster Network

The mobile nodes are grouped into clusters and a cluster head is elected. All nodes that are in the communication range of the cluster head belong to its cluster. The gateway node is a node that is in the communication range of two or more cluster heads.

LCC (Least Cluster Change Algorithm)

In the dynamic network environment cluster head scheme can cause performance degradation due to frequent cluster head elections [5].

Using the LCC algorithm, cluster heads only changes

When two cluster head come into the contact, tie is broken either using the lowest ID or highest connectivity algorithms [9]. On receiving the new packet, a node finds the nearest cluster head along the route to the destination according to the cluster member table or the routing table.

Table maintained by each node-

Cluster member table

It has mapping from each node to its respective cluster head.

Routing Table

Use to find next hop in order to reach the cluster head selected in one and transmit a packet to that node.

B. Reactive Routing Protocol

Reactive routing protocols find out routes whenever required and search to set up the routes.

Reactive Protocols have less overhead as the routes are determined on demand.

Example: Dynamic Source Routing (DSR), Ad-hoc On Demand Distance Vector (AODV) and Ad-hoc on Demand Multipath Distance Vector (AOMDV)

Dynamic Source Routing (DSR): Dynamic Source routing protocol (DSR) is for wireless mesh network and is based on the method which is known as source routing. It is very identical to AODV as route is formed on demand when the transmitting computer requests the one. Every intermediate node which broadcasts a route request packet adds its own address identifier to the list carried in the packet [3]. A reply node is generated by the destination node which includes list of the addresses which is received in the route request and then transmits it back along this path on source. Routes maintained in the DSR, is accomplished through confirmation that nodes generate when they can verify that the next node has successfully received the packet. This confirmation can be link layer acknowledgements or the network layer acknowledgement specified in the DSR protocol. When the node is unable to verify the successful reception of the packet it tries to retransmit it. When the finite number of the retransmission fails, the node generate route error message and that specifies the problem for transmitting it to the source node.

Ad-hoc On Demand Vector Routing (AODV): AODV is a reactive protocol which manages the routing information of the active node. In AODV each node holds the next hop routing table which saves and manages only the destination. In the routing table a route entry expires if it has not been used for the predefined expiration time [7]. AODV also follows the destination sequence number. In AODV the concept of the buffer limit is used in which end to end delay analyzed and determine the network performance. It uses the route discovery technique if a no path is established and a source node want to forward the packet to the destination node. In the route discovery phase the source node forwards the RREQ (route request) packet. RREQ packet involve address of the destination node.

C. Hybrid Routing Protocol

Hybrid Wireless Mesh Protocol (HWMP) is defined as the IEEE802.11 routing protocol for a wireless mesh network. HRP is a hybrid protocol which classifies network into a number of sectors, which makes the hierarchical protocol. It is based on AODV and tree based routing protocol.

III. PROBLEM DOMAIN:

3.1 Finding the cluster head node

The cluster-head gateway switch routing protocol (CSGR) uses a hierarchical type of networks topology, unlike other table-driven routing protocols that employs flat topologies. Cluster - head gateway switch routing protocol organizes nodes into clusters, with coordination among the members of each cluster entrusted to a special node which is known as cluster-head. One of the problems in cluster gateway switch routing protocol is to find the cluster-head. The cluster-head node should have best configuration that is, throughput, energy etc. On the basis of these characteristics the nodes of cluster are analyzed and the cluster-head is selected.

Here we can see in the figure that each cluster has got one cluster-head, this cluster-head has to be determined for each cluster. Example, in the figure the cluster heads are node1, node6, node2, node5 and node3.

Figure-3 Route establishment in CGSR-

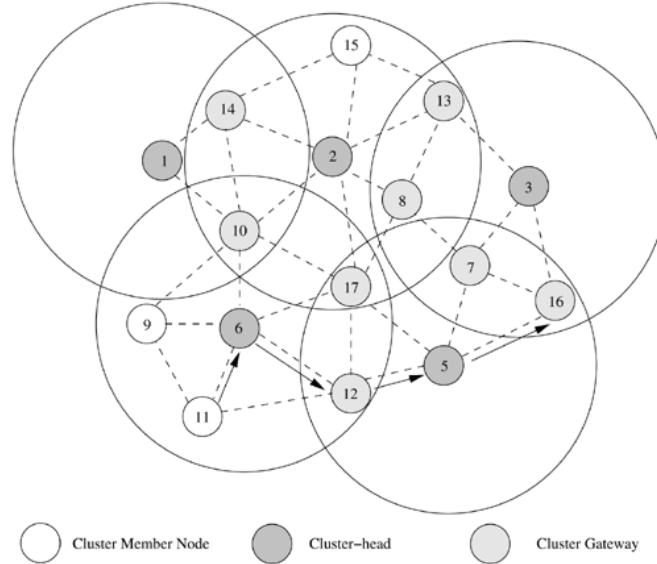


Fig.1: System Model

3.2 Problem of Overloading in a cluster

Another problem which is there in cluster head gateway is problem of overloading in cluster. If in a cluster number of increases in number such that the cluster-head of cluster is unable to manage gateways and the transmission of data among them then this creates the problem of overloading in a cluster. This problem of overloading in the cluster has to be managed because this can lead to failure in the transmission of data among the gateways and consequently among clusters.

Since cluster-head gateway routing protocol is a hierarchical routing scheme which enables partial coordination between nodes by electing cluster-heads. Hence, better bandwidth utilization in the cluster is possible. It is easy to implement the priority scheduling schemes with following scheduling schemes- token scheduling and gateway code scheduling. In order to avoid gateway conflicts, more resources (such as additional interfaces) are required to be implemented.

3.3 Problem of making a new cluster head

In some of the cases, the cluster-head of cluster leaves the cluster. This happens when the nodes are mobile, that is, they change their position from one place to another. The situation of selecting new cluster-head comes when-

- The number of nodes in the cluster increases suddenly and the cluster-head is unable to handle the nodes. Since the nodes are mobile therefore they change their position and move from one cluster to another cluster, hence this result in the problem of overloading.
- The node of one cluster moves to another cluster due to mobility of nodes, therefore new cluster head has to be made to manage that cluster.

IV. IMPLEMENTATION :NETWORK DESIGN

There Network Simulator Version 2.35: NS2 is a simulator generally used for networking research. NS2 provides notable support for simulation of routing, TCP, and multicast protocols on wired and wireless protocols. A simulator model of a real world system is essentially a popularization of the real world system self.

NS-2 Architecture

NS-2 supplies users executable command ns which takes on input argument. Users feed the name of a TCL simulation script as an input argument of an ns2 executable command ns [10]. In most of the cases, simulation trace file is created which is used to plot graph and / or to form animations.

Simulation Scenario

This section provides the understanding about the simulation scenarios under which the experiments are performed. To demonstrate the multicast multipath routing protocol and their key simulation scenarios are proposed in this section.

Initialize Global Variables

```
set ns_ [new Simulator]
set tracefd [open AODV_20p.tr w]
$ns_ trace-all $tracefd
$ns_ use-newtrace
set namtrace [open AODV_20p.nam w]
$ns_ namtrace-all-wireless $namtrace $val(x) $val(y)
$ns_ color 1 Blue
$ns_ color 2 Red
# set up topography object
set topo [new Topography]
$topo load_flatgrid $val(x) $val(y)
# Create God
create-god $val(nn)
# Create channel #1 and #2
set chan_1_ [new $val(chan)]
```



```

set chan_2_ [new $val(chan)]
# configure node, please note the change below.
$ns_ node-config          -adhocRouting $val(rp) \
                          -llType $val(ll) \
                          -macType $val(mac) \
                          -ifqType $val(ifq) \
                          -ifqLen $val(ifqlen) \
                          -antType $val(ant) \
                          -propType $val(prop) \
                          -phyType $val(netif) \
                          -topoInstance $topo \
                          -agentTrace ON \
                          -routerTrace ON \
                          -macTrace ON \
                          -movementTrace ON \
                          -energyModel $val(energymodel) \
                          -idlePower 1.0 \
                          -rxPower 1.0 \
                          -txPower 1.0 \
                          -sleepPower 0.001 \
                          -initialEnergy $val(initialenergy) \
                          -channel $chan_1_

# creating mobile nodes for simulation
puts "Creating nodes..."
for {set i 0} {$i< $val(nn)} {inc i} {
    set node_($i) [$ns_ node]
    $node_($i) random-motion 0      ;#disable random motion
}

# Adding connection pattern which is created using setdest, parameters shown below
# ./setdest -n 20 -p 1.0 -M 20.0 -t 500 -x 750 -y 750 >scen1forAODV-n20-t500-x750-y750
puts "Loading random connection pattern..."
set god_ [God instance]
source $val(cp)
# Setup traffic flow between nodes
# CBR connections between first 10 nodes to second 10 nodes
puts "Loading scenario file..."
source $val(cv)
# Define initial node position
for {set i 0} {$i< $val(nn)} {inc i} {
    $ns_ initial_node_pos $node_($i) 30
}
# Tell all nodes when the simulation ends
for {set i 0} {$i< $val(nn)} {inc i} {
    $ns_ at $val(stop).000000001 "$node_($i) reset";
}
# Ending nam and simulation
$ns_ at $val(stop) "finish"
$ns_ at $val(stop).0 "$ns_ trace-annotate \"Simulation has ended\""
$ns_ at $val(stop).000000001 "puts \"NS EXITING...\" ; $ns_ halt"
proc finish {} {
    global ns_ tracefdnamtrace
    $ns_ flush-trace
    close $tracefd
    close $namtrace
    exec nam AODV_20p.nam &
    exit 0
}
puts "Starting Simulation..."
$ns_ run

```

V. CONCLUSION

This paper presents description of the mobile ad-hoc network, their routing protocols and issues of these routing protocols. This paper mainly concentrates on the major issues of cluster-head gateway switch routing protocol. When the nodes are mobile in a cluster then the problem of selection of cluster-head arise, hence the key objective is to enhance the optimum cluster head selection when the cluster head is mobile along with the nodes.

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