Service composition using QoS parameters in mobile Ad-hoc networks

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***Abstract* – Multiple independent QoS constraints can be satisfied simultaneously by considering the multiple constraint Quality of service routing. The objective of this paper is to derive the optimal path by considering the four significant constraints such as bandwidth, end to end delay, response time, number of intermediate nodes. This paper regards to the three input variables like Low, Medium and High, five output variables like Very low, Low, Medium, High, Very high. By using fuzzy logic we calculate a rating for a service. To provide the service, the service provider with high rating is selected to provide the service. This system mainly considers two variables, service provider and service requester. Service requester requests the service and a service provider provides the service based on received requests. The simulation results shows that our proposed method SCQM performs better compared to AODV in terms of Response time, Bandwidth, End to end delay and hop count.**

Index Terms – Fuzzyfication, Defuzzyfication, Service Provider (SP), Service Requestor (SR), MANETS.

1. INTRODUCTION

A network is defined as a set of entities being connected to form a topological structure. According to network ranges, network can be classified into three forms such as LAN, MAN and WAN.

LAN: Computers are connected with in a limited area. For example school, office and a home.

MAN: In MAN, two or more devices or networks are interconnected. Example: metropolitan area networks.

WAN: In a WAN, a number of WAN and MAN are interconnected.

In a network, we can use different types of topologies. Those are

(A). Bus Topology
(B). Mesh Topology
(C). Ring Topology.

Networks are divided into three types based on its connectivity (i). Wired (ii). Wireless (iii). Ad-hoc.

The significant feature of the MANET is that each node of this infrastructureless network acts as a router to carry the signals to another node. It is an IP based network without any central administration and without a proper firewall. Here, nodes are dynamic in nature i.e., they move randomly but have the capacity of self-organizing arbitrarily. Mobile nodes communicate with the other nodes in a radio range directly, if they need to communicate with the other nodes apart from the range, then they use the routers as a medium to communicate with the other nodes. Then these types of networks can be called as multi-hop networks, as they use intermediate nodes to relay the message hop by hop.

Each node in ad-hoc network can take the role of host and router which permits data transmission through them. Some of the advantages of mobile ad-hoc networks are listed below:

(a) Regardless of geographic position they can give access to information and service
(b) They are independent from the central network administration.
(c) Here the nodes can act as routers.
(d) Nodes are more flexible.

(e) Because of decentralized administration they are robust.
(f) The network setup can be done at any time and any place.

A kind of wireless network which can be designed for fulfilling particular purpose that is served by establishment of the whole set up on the fly.

Four effective parameters are considered for rating the service in this paper. They are Response time, Bandwidth, End to End Delay and Hop count. By applying the fuzzy membership function to the corresponding parameters we can able to calculate the rating of the service. In the membership function we use the Triangular method which is suitable for calculating the rating of a service. After calculating the rating to service, based on available services routing can be done.

A request is placed by the user for a service to the service provider. Service provider utilizes the shortest job first mechanism for allocating the resources. This algorithm states that the smallest distance between the sources and designation can be executed first. The motivation of this paper is to enhance the Quality of Service (QoS) and Quality of Information (QoI), and minimize the cost of service thereby maintaining the reliability i.e. Reduce the number of failure rates while providing the services.

2. RELATED WORK

Nageswara Rao [1] stated that WBTQ (Weightage Based Trusted QoS Protocol) provides the secure based environment by calculating the trust worthiness of a node in the network. By giving the weightage to quality and trust values the best route can be identified, which is the more flexible and feasible solution.

Abrar Omar Alkhamisi [2] stated that the proposed method increases the throughput as compared to AOMDV protocol. TS-AOMDV Protocol provides the feature such as detection of attackers. Finally trust based routing protocol is adopted here.

Rahul Talreja [3] has mainly concentrated on the behaviour of the trusted nodes in the network. It proposes an algorithm that describes the assumptions that all the nodes are to be comprised for the sensors. Which can finally give the information about the user and sensor behaviour.

Versa matte [4] is discussed on the performance evaluation of trust based AODV protocol. It mainly considered the quality of service to the smallest path identification. It repeatedly changes the source and destination in the network. It can dynamically form the route.

Murari Bhattacharyya [5] clarifies that if a chosen trusted authority fails to provide a service, then how to choose a next trust authority to fulfil the service. It considers two parameters such as alpha and beta. Those can be able to perform the selection of trusted network in spite of primary authorization failure.

Azeem irshd [6] explained about authentication of nodes to the 4G services and communicating node as a part of certificate chain based groups. Their scheme merged the key management and security management and finally get an optimized solution.

3. PROPOSED MODEL

Two major roles in the service oriented mobile network are considered. They are

(i) Service provider(SP)
(ii) Service requester(SR)

(i) Service requester (SR):

The service requester acts as a user, which can place a request. There may exists multiple users requesting several requests. According to changes in their location of service, a requester can place the different requests. Service requester can also place its owners' requests too.

(ii) Service provider (SP):

The main objective of this service is to respond for a particular service request. The service provider retains the three parameters for maximum user satisfiability. The parameters are

(a) Quality of Service
(b) Quality of Information
(c) Cost

These parameters can manage the service provider all the time. When the location of the service requester changes then SR can requests the service. Then the service provider can provide the service by managing the parameters. The service requester can expect the maximum quality of service and quality of information and minimizing the cost for providing the service.

For example, let us consider a person has placed a request such as "Take me to a good restaurant". Such that the service provider can provide the route from current location by considering the available resources. After that he can place a new request such as "take me to a super market" followed by "beauty parlour" then service provider can provide the route to both within a less distance. Then the service provider is to consider the QoS, QoI, cost based on resources. Like that by changing the locations of service requester he can be able to place the repeated requests. Then the service provider need to provide the service.

4. FUZZY INTERFACE SYSTEM TO CALCULATE THE RATING OF A SERVICE

Fig (i) represents the structural representation work flow to the fuzzy interface system (FIS). Here we mainly consider the three major steps involved in the fuzzy logic system (FLS). The inputs to the FLS are

(i). Bandwidth
(ii). Hop count
(iii).Response time
(iv). Delay.

(A) Inputs and Outputs for the Fuzzy Function:

The four input variables are to be fuzzed such as bandwidth, Number of intermediate hops, response time, and delay. In the MANETS existing system uses the terms "low", "medium", and "high". These can be used to calculate the rating of a service.

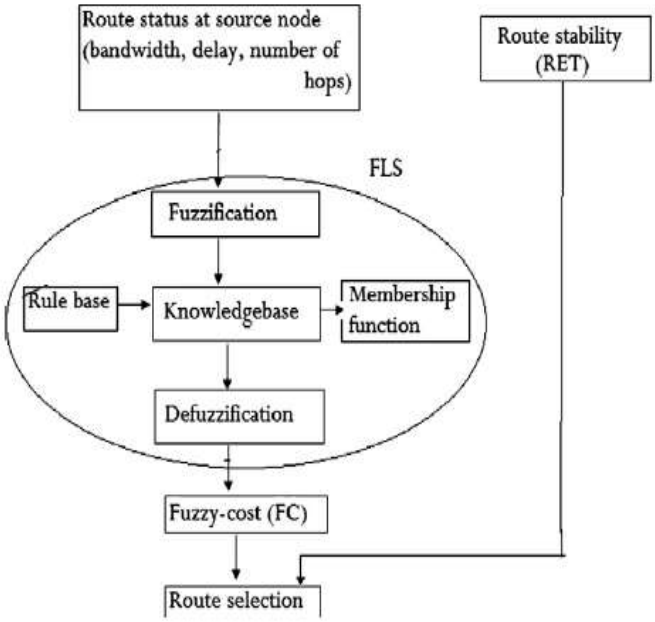

Figure 1 Selection of multi objective optimal route.

To consider the output variables cost the terms "very low", "low", "medium", "high", "very high" are to be used. Triangular membership function are used to calculate the rating- fig (2) and fig (3) used to represent the output variables.

(B) Rule Structure for Knowledge Base:

Fussy logic system can uses the 'IF-THEN' rule base structure. It uses the AND operation to combine the all input variables. One of the examples is to describe the input-output mapping.

Rule (i): IF (Hop count is less) AND (High Bandwidth) AND (Low Response time) AND (Low End to End delay) THEN cost is "very less".

The possible interpretation shows that maximum bandwidth, minimum number of intermediate hopes and minimum delay are the favourable inputs and get very low cost.

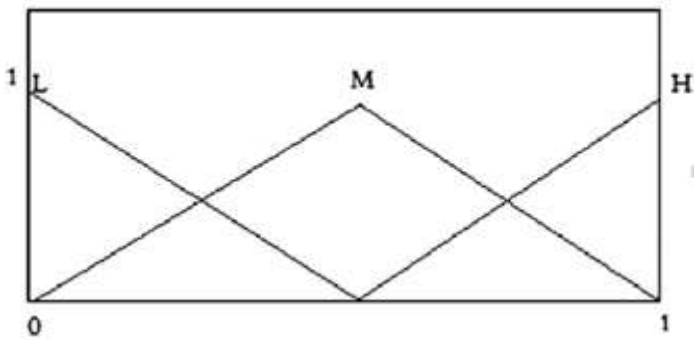

Fig 2: fuzzy membership function for bandwidth, delay, response time and hop count

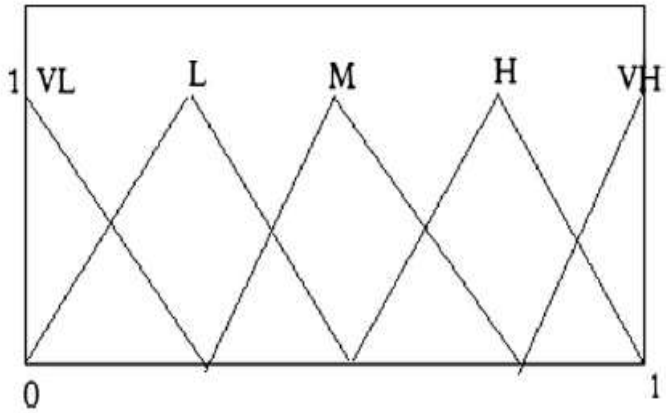

Fig 3: Fuzzy membership function for cost

Table 1 Fuzzy logic system rules.

Input			Output
Bandwidth	End-to-end delay	Number of hops	Cost
Low	Low	Short	Low
Medium	Low	Short	Very low
High	Low	Short	Very low
Low	Medium	Medium	Medium
Medium	Medium	Medium	Medium
High	Medium	Medium	High
Low	High	Long	Very high
Medium	High	Long	Very high
High	High	Long	Very high

(C) Defuzzyfication:

The crisp value can be extracted from the fuzzy set as a representation value is to be known as defuzzyfication. We have different types of defuzzyfication processes available. In that we all considering the centroid of area method is to be taken for the defuzzyfication [7].

$$Z_{COZ} = \frac{\int_z \mu_A(Z)_{zdz}}{\int \mu_A(Z)dz} \quad (1)$$

Here μ_A (Z) is the aggregate output for the membership function. Finally the cost is extracted as the output.

5. QoS CONSTRAINT SERVICE DISCOVERY AND SERVICE COMPOSITION:

Here we mainly consider three steps to provide the services to the service provider such as every service provider need to authentic to provide the service. The steps are:

(i) Service Advertisement

(ii) Dynamic Service Composition

(iii) Service binding

(i) Service Advertisement:

When the peer node can shows the interest on the service provider need to advertise its service availability [5] [7]. While providing the services the service provider can responds through advertisement only. The service provider can specially responds advertisement with Ad_{sp} by comprising the four-tuple records, each and every abstract service S_K can provides as follows:

Ad_{sp}: [K, Q_K, D_K, C_K] for S_K

Here K= Index of the service S_K

Q_K= the level of QoI

D_K= Service delay level

C_K= Service cost.

(ii) Dynamic Service Composition:

For our convenience, we used m as index service request, K as index services, m represents as service request and i, j, r as index nodes. We mainly requires the abstract services such as S_K when the S_R can issue a request (Example: Take me to a tiffin centre nearby college). Based on receiving a request from S_R then it broadcasts the abstract services. In this we are considering the abstract services (Example: Transportation services, Food services etc.). Based on the service request, S_R can construct the service composition specification (SCS) to specify the service plan for the receive request.

Example for SCS is:

SCS_m = < [S1], [S5, S7], [S2], [S8], [S9, S3], [S4] >

Here [S5, S7] represents that S5 and S7 are to be executed concurrently and [S2], [S8] can represent that they are executed sequentially. The abstract service level service request level from the used can be represented below.

$SCS_m^{THRES} = (Q_m^{THRES}, D_m^{THRES}, C_m^{THRES})$

$S_k^{THRES} = (Q_K^{THRES}, D_K^{THRES}, C_K^{THRES})$

Finally the S_R can select the best S_P among all the remaining S_P's by considering the quality levels such as both abstract service level and service request level. If we can't be able to meet the quality levels then we can say that there is no qualified S_P's and O_m be considered as a failure.

(iii) Service Binding:

SP is capable of providing the various multiple abstract services to be selected. To execute multiple abstract services according to service

request. Here, the S_P can be committed to a single request to avoid the schedule conflicts in the concurrent service requests and to avoid decreasing of SP's service quality due to heavy workloads. By committing SP to the single request at a time can able to provide the availability and able to commit to the single request.

6. Simulation Results:

In this section we compare the number of services involved in the composition versus Average packet delay, response time, hop count and bandwidth. Table 3 describes the set up for simulation.

Table 2 Simulation parameters.

Parameters	Value
MAC layer	IEEE 802.11
Simulation area (m^2)	1000 m * 1000 m
Simulation time	60 s
Number of nodes	25
Bandwidth	2 Mbps
Node mobility speed	0–60 m/s
Mobility pattern	Random way point
Traffic flow	CBR
Packet size	512 bytes
Transmission range	250 m

Table 3: Set up for simulation.

6.1 End-to-end delay:

The quantity of time needed for information to reach destination from source. In the proposed system the time required to transmit the information from one end to another end is reduced. It also leads to increase in throughput of the system.

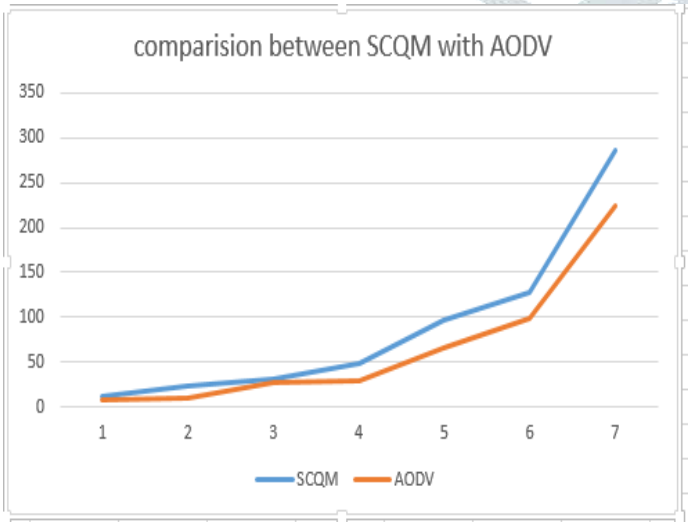

Fig 4: comparison among the AODV and SCQM through delay parameter

6.2 Bandwidth:

Bandwidth can be balanced through maintaining the transmission of related information through all the nodes. There by consisting of a range of frequencies with in the band. In proposed system we maintain the bandwidth frequency throughout service allocation. Finally increases the performance of service composition.

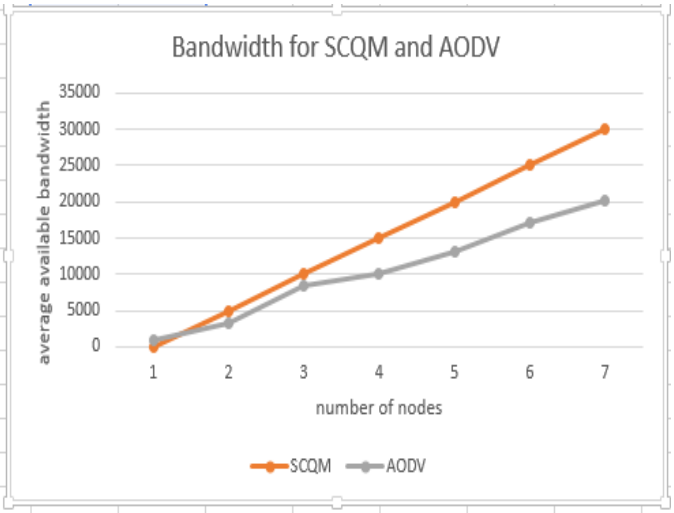

Fig 5: bandwidth frequency comparison between SCQM and AODV

6.3 Hop count:

The proposed system takes less number of hops compared to AODV protocol. Hence, the proposed method is effective than AODV protocol.

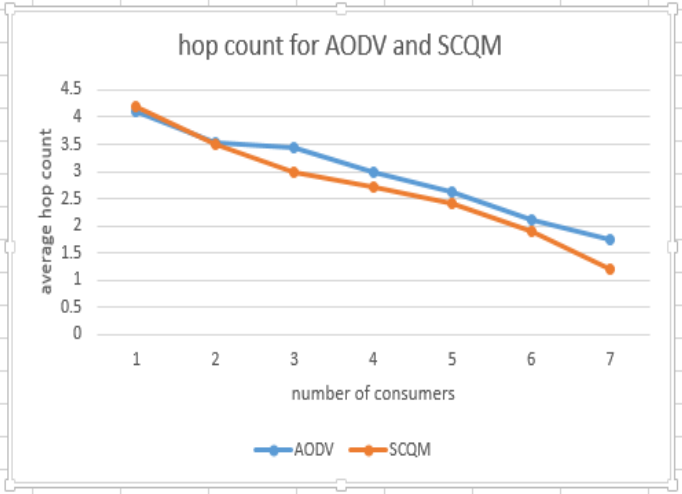

Fig 6: Number of hop count between the nodes

6.4 Response time:

Response time is defined as time taken to respond the request. As the proposed protocol considers all the QoS parameters the response time is increased when compared to the AODV protocol.

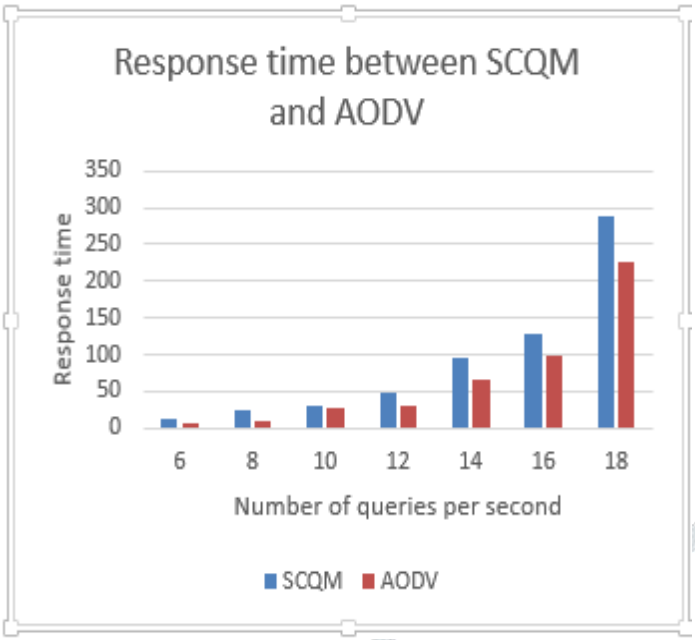

Fig 7: response time for the AODV and SCQM protocols.

7. Conclusion and future work:

Here, we mainly considered four parameters to calculate the rating of the service, Bandwidth, End to End delay, response time and Hop count. By considering these parameters we can get the best optimal node to provide the services. The rating of a service leads to maintain the trust to the corresponding service. The trust based composition is more effective when compared to non-trust based service. In the future, we will consider various parameters such as throughput, turnaround time to calculate the rating of a service to get the most appropriate rating to the corresponding service.

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