**4.** c.

Wireless gateway placement is an important design factor for the deployment of MANETs networks. If a wireless gateway is placed at the edge of the network, the average communication cost will intuitively be much higher than if the gateway was placed in the center of the network. It is thus very important to place the gateways so as to minimize the number of gateways to keep cost at a minimum. At the same time, their placement should meet the end user application performance metric of minimum bandwidth and an upper bound on the delay. Along with QoS constraints, other factors like minimizing interference, increasing fault tolerance and provisioning for demand growth are also important factors that influence the location of the wireless gateways.

**how the gateways affect the throughput in the ad hoc network. The throughput’s dependency on gateway positions, number of gateways and handover properties is sought uncovered by simulations. The results show that the relative positions of gateways in ad hoc networks may have defining impact on the performance of the network. The average path length and the gateways’ shared interference coverage are parameters that affect the performance.**

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The gateways are in the transmission range of other nodes in the ad hoc network, and they affect the performance of the ad hoc network, depending on their position, not only as forwarders of traffic into the ad hoc network, but also as receivers of traffic from the ad hoc nodes. Positioning the gateways strategically could improve the gateway coverage and reduce the path length for traffic traveling the ad hoc network.

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There are several different ways the gateways could be positioned in the ad hoc network:

1- Static, placed independently of the ongoing scenario

2- Semi-mobile, moved only when necessary

3- Mobile, but collocated with a regular ad hoc node

4- Mobile and independent of the ad hoc nodes

Several issues may limit the possibilities for moving a gateway: the access network availability (wired or wireless), available power sources, the physical gateway size and type of terrain.

In most cases the gateways will not be optimally positioned relative to the ad hoc nodes. Thus, we need to understand how this affects the capacity and, in the event that the gateways’ positions can be changed or their number controlled (e.g. by turning gateways on or off), be able to advice the best action.

**7. Virtual Gateway: Optimization Gateway Placement for MANETs.**

(V\_GW) is a special fixed node (physical infrastructure) that delivering a better service to the nodes, (V\_GW) has successfully to discovery and selection for the nodes of MANET to connect with Internet. It’s seen as an unmoving node in the MANET. The (V\_GW) is an internet portal designed to provide mobiles nodes to access internet services. Previous studies have indicated that location of gateway at the center of the network topology gives better results compared with gateway positioned at the edge. We suggest that the location of (V\_GW) in the center of network providing better Quality of Service (QoS) rather than places it in the edge of the network. Therefore, V\_GW is a one of the important solutions that solved the problem gateway position in the edge of network.

In addition to the gateways’ positions, their number also affects the performance of the ad hoc network. Operating with only one gateway, for example, the connectivity with external networks could be vulnerable, both in terms of reliability and coverage. Introducing more gateways provides several important benefits.

- First, the probability of having a working connection to the access network increases. If one gateway fails, nodes can send traffic via another gateway.

- Second, with several gateways the average path length for traffic traveling between the ad hoc network and external networks is reduced.

- Third, the risk of partitioning and disconnection from the access network in case of drifting is reduced. Finally, load balancing may be employed by routing traffic in such a manner that the capacity of both or all gateways is better utilized than the capacity provided by only one gateway. To control the number of gateways, it is assumed that the gateways can be activated or deactivated as necessary.

**5. ISSUES RELATED TO GATEWAY PLACEMENT**

A. Bandwidth:

Bandwidth is a rate of data transfer, measured in bits per second. While placing the gateways, one must keep in mind that the placement satisfies the bandwidth requirement of all the clients.

B. Congestion:

In MANET most of the traffic is forwarded towards the gateway, so some gateways might be overloaded while some seldom used. So one of major issue is each gateways should be placed in such a way that load is properly balanced and no node is over congested.

C. Delay:

There is no direct communication between the source node and the destination node in the network, thus the data sent to the destination from the source has to be stored and transmitted by many intermediate nodes. The transmission delay time is the storage time and transmission time of the data. If the transmission path goes through too many intermediate nodes, then the frequent storage and transmission on intermediate nodes would add the transmission delay time, and the efficiency of communication will decrease. While placing for the placement of gateways one must keep in mind that the delay in transmission should be minimum.

D. Interference:

Interference in MANET is a key issue impacting performance. The gateway node should be placed in such a way that the throughput is maximum and interference among gateways is minimum.

E. Distance between the Gateways:

Interference among gateways will degrade network throughput if gateways are placed densely and if the distance between the gateway is too much then the signal strength is degraded. So distance between gateways should me optimum.

F. Traffic Demand v/s Location:

Location of the gateway has a great impact on network performance. If gateways as located densely then it may lead to interference and increase of setup cost and if located sparsely then it may lead to poor signal strength. So choosing a proper location of gateways is another issue.

G. Cost v/s Number of Gateways:

If we add more number of gateways, it will improve network throughput but due to expensive construction of wired links it will increase the cost. So it is necessary to minimize the number of gateways and still do not compromise on throughput or delay.

H. Coverage:

It means number of nodes served by each gateway. Each MANET must be covered by more than one gateway so that one of the gateway fails the MRs may be covered by the backup gateway.