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QoS Based Routing Mechanisms in Mobile Ad hoc Networks: A Survey

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Abstract:A mobile adhoc network is an infrastructure less network in which the mobile nodes can form a dynamic topology. Every node in the network has a routing function which forwards the data packets through intermediate nodes. The two nodes are communicates directly, if it is within communication range otherwise, with the help of intermediate nodes it will communicate. The characteristics of the mobile adhoc network are high mobility and easy deployment. But it is difficult to guarantee the quality-of-service (QoS) in mobile adhoc network because of the node mobility, disputation for channel access, a lack of centralized co-ordination, and the unreliable nature of the wireless channel. Different techniques are used for QoS guarantees in terms of bandwidth, end to end delay, Packet delivery ratio, energy and mechanism overheads.This survey comprehensively studies the issues in the QoS routing and presented various QoS routing mechanisms for improving Quality-of-service.

Key words: Mobile Adhoc networks, Quality-of-service (QoS), Routing, Energy consumption

1. INTRODUCTION

Mobile adhoc network is named as MANET which is one of the most used wireless technologies in the real-time applications. This category of network is a decentralized structure and does not require a central transmission system like the incident of disasters or the neccasity of setting up temporary networks. The mobile adhoc network can be located at any place offering access to information and services in spite of geographic position [1]. MANET is used in a multiplicity of applications such as disaster relief, military applications, inter-vehicle communications, road traffic management, business and entertainment.

1.1 Characteristics of MANET:

Characteristics of the mobile ad-hoc network are:

- In the mobile adhoc networks, every node acts as host or router.
- Nodes can connect in network in a dynamic manner.
- Mobile nodes are described with less memory, power
- High user density and high mobility
- Centralized transmission system is not required
- Nodal connectivity is irregular

A typical architecture of MANET fig1.1[16] will be as follows

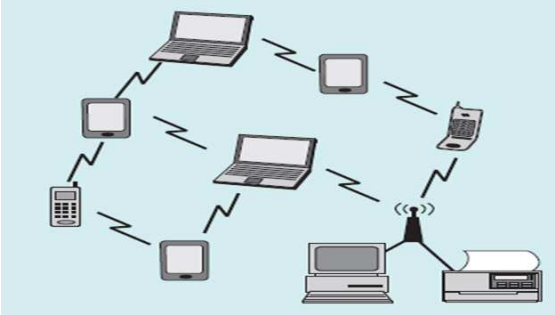

Figure 1. Architecture diagram of MANET

Mobile adhoc network is a group of mobile nodes in which a dynamic topology is formed. The nodes in the mobile adhoc network maintain network connectivity without using the fixed infrastructure like base stations or access points. Each and every node in the mobile adhoc network has a routing function which communicates the packets through the intermediate nodes. But improving quality-of-service is an important problem in the mobile adhoc networks. Quality-of-service is defined as the level of performance in the mobile adhoc network needed by a category of network traffic. Improving QoS requirements is an essential in many situations like military communication. There are many problems in routing QoS traffic in the mobile networks.

Some of the problems in the mobile adhoc network are energy consumption, link stability, reliability, end-to-end delay, throughput etc. Because it is essential to decrease the power consumption to prolong the battery lifetime of the network. . Consequently, the transmission power

should be carefully selected because the large transmission power level leads to the waste of battery energy. Also, the selection of more stable routes under node mobility is an important consideration [2] [3]. Because of high mobility, interference of the mobile adhoc network is recurrently change; so that the links along the path may be fail. The link and path stability among the nodes permits the diminution of control overhead and also improve the energy efficiency in the adhoc networks.

Reliability is an important metric which provides the continuous connection in the network. It is defined as the capability of continuing to achieve a particular operation in spite of the effects of malfunctioning and damage. The reliability analysis always refer to the terminal reliability, which means the capability that partial or all the devices remain linked, on the assumption that there is failure of link and node. In this survey, several QoS routing mechanisms are suggested for improving the network performance. The QoS routing mechanisms such as link -stability and Energy aware Routing protocol which computes the link stability metric and energy aware metric. Also, BATMAN Routing Protocol, Energy-efficient genetic algorithm mechanism, QoS-aware routing (QAR) protocol is suggested and the performance is analyzed .

2. QoS BASED ROUTING MECHANISMS

2.1 Link-stability and Energy aware Routing protocol

Floriano De Rango et.al [4] suggested link-stability and Energy aware Routing protocol in the mobile adhoc networks. The main target of this concept is to enhance the stability of the link and minimum energy drain rate in mobile ad hoc network (MANET). In this method, the residual lifetime of the link is estimated so that the link stability is computed. If the remaining lifetime of a link, the consistency of the link is higher. If the average transmission distance between the nodes goes beyond the transmission radius, the link breakup takes place. In the energy-aware metric, the energy drain rate is computed. Actually, in the wireless sensor network different nodes take different amount of energy for transmitting the same data packets. The path is selected based on the energy metric.

2.2 BATMAN Routing Protocol

In [5] Ramon Sanchez-Iborra et.al presented BATMAN protocol for improving network performance in the mobile adhoc networks. In this work, the performance is computed for the BATMAN routing protocol supporting a multimedia service on low battery-consumption nodes. Particularly, Ramon Sanchez-Iborra assess by simulating the MeanOpinion Score (MOS) estimated by the PESQ model ina number of concurrent VoIP transmissions with dissimilar MANET configurations utilizing low transmission power. Firstly, the effect of the physical layer is evaluated on BATMAN characterizing the wireless transmission channel by the Nakagamim propagation model. Thereby, examine the consequence of the medium hostility on the performance of a variable number of concurrent VoIP calls accessing the system interms of QoE (in a MOS scale) and QoS (delay, packetloss, etc.).

2.3 QoS-aware routing (QAR) protocol

Lajos Hanzo II et.al [6] discussed QoS-awarerouting (QAR) protocol and an admission control (AC) protocol for Multirate mobile ad-hoc networks. The main contribution of this work is firstly a low overhead extension to the staggered admissionControl (STAC) protocol is presented, which utilizes pretested backup routes for improving throughput in the failure routes. Secondly, a multirate-aware version of STAC is also suggested which co-operates with a customized rate switching mechanism at the MAC layer, and a QAR protocol to aid in coping with shadow-fading-induced signal strength fluctuations. The above mentioned protocols are also integrated and all of the new protocols are computed in a simulated highly dynamic mobile and shadow fading-afflicted environment.

2.4 Energy-efficient genetic algorithm mechanism

Ting Lu et.al [7] suggested an energy-efficient genetic algorithm mechanism for improving quality-of-service in the multicast routing problem. Because, in the mobile adhoc networks power awareness is a crucial problem. It is necessary for reducing energy consumption to extend the network lifetime. As a result, the transmission power should be carefully selected because the large transmission power leads to high energy consumption. In this work, the energy-efficient delay-constrained multicast routing algorithm is presented for extending the network lifetime. This source-based algorithm considers the energy consumption and also end-to-end delay in the selection of route. The crossover and mutation process are applied on trees directly, which simplifies the coding process and excludes the coding/decoding process. This heuristic mutation technique can enhance the total energy consumption of a multicast tree.

2.5 Graph-Based Reliable Routing Scheme

Mahmoud HashemEiza et.al [8] presented evolving graph-based reliable routing method in the vehicular adhoc networks. The communication links in the vehicular networks are more recurrently break than in MANETs. So, the routing reliability in the highly dynamic networks is an important consideration. The main intent of this work is a novel evolving graph-based reliable routing method which suggested for the vehicular adhoc networks. The innovation of this work lies in its exclusive design of a reliable routing protocol which considers the properties of the topology in the VANET communication graph using the extended evolving graph. The data delivery service is mostly affected because of the network disruptions and link breakages. So, it is significant to select the most reliable route for improving the performance. The contributions are:

1) Develop a new link reliability model according to the mathematical allotment of vehicular movements and velocities on the highway.

2) To detain the evolving characteristics of the VANET, the evolving graph model is extended and considers the link reliability metric.

3) Based on the extended evolving graph model, a reliable routing protocol is developed for identifying a new route. So, that the routing overhead is reduced significantly and save the network resources.

2.6 Cluster-based QoS routing algorithm

Larry C. Llewellyn et.al [9] presented a fault tolerant cluster-based QoS routing method in the mobile adhoc networks. The major objective of this work is to provide fault tolerance in the mobile networks. Fault tolerance is a significant characteristic in the quality-of-service. A fully distributed cluster-based (FDCB) algorithm is used for the QoS routing in MANETs. To provide scalability, the FDCB is extended which is called extended fully distributed cluster-based algorithm (EFDCB). This algorithm is only considering a fraction of the total number of network links when identifying a new probable path by using local recovery in the cluster. So that the burden of negotiating newly calculated QoS paths in the FDCB is reduced. For this motive, the new local method is anticipated to have a extensive runtime advantage resulting inenhanced QoS route recovery time. The QoS disruption time and packet loss is reduced due to the faster QoS recovery time.

2.7 New Distributed Application and Network Layer Protocol

In [10] Floriano De Rango et.al suggested a new Distributed Application and Network Layer Protocol for Voice over IP (VoIP) in Mobile Ad Hoc Networks. When handling the dynamic environments, distributed architecture is necessary for reducing the cost. A mobile adhoc network is based on the peer-to-peer method and every node contributes in the organization of the whole network. Because of the intrinsic distributed nature, VoIP over MANETs is a challenging issue. A new protocol is presented which is able to make sure a Quality of Service (QoS) level for VoIP calls over a MANET and to handle a higher number of calls in the system. For the optimal path selection from source to destination, novel metric and utility functions are presented, regarding the QoS parameters for VoIP quality. Specifically, an objective metric like R-factor is considered and a flexibility index is defined for increasing the number of acceptable VoIP calls.

2.8 Novel reliability analysis

Xibin Zhao et.al [11] suggested a reliability investigation for the mobile adhoc networks. In this work, the node mobilityeffect and the node reliability based on a real MANET platform are modeled and analyzed. For the reliability analysis, an effective Monte Carlo method is presented. This Monte Carlo method is a functional simulation tool for the estimated calculation of the network reliability, particularly for the large scale complex network. according to this reliability is decided and progress the rightness and efficiency of the mobile adhoc networks.

2.9 Optimized Multicast Routing Algorithm

LIU Tianjiao et.al [12] presented optimized multicast routing method in the mobile adhoc networks. According to the data delivery structures, there are two categories in the multicast routing protocols: one is tree-based and another one is mesh-based protocol. The tree-based protocol has high forwarding efficiency and low bandwidth consumption and they have poor robustness because only one link exists between two nodes. In the lightweight ad hoc networks, the tree based multicast routing protocol MAODV (Multicast Ad hoc On-demand Vector) has high performance. But if the load of the network increases, the quality-of-service is degraded. In this work, the effect of network load on MAODV protocol is addressed and presents the optimized protocol MAODV-BB(Multicast Ad hoc On-demand Vector with Backup Branches) for enhancing robustness, It integrates the benefits of tree structure and the mesh structure. This method not only updates shorter tree branches and also constructs a multicast tree with backup branches.

2.10 Light-weight trust-based QoS routing algorithm

In [13] Bo Wang et.al suggested a trust-based QoS routing method in the mobile adhoc networks. In this work, the definition of trust and QoS parameters computation is estimated into a classic routing for improving security of networks. In this method, the trust degree is directly acquired between nodes and by recovering neighbors' recommendations for enhancing the establishment of trust in MANETs. Furthermore, because of the NP-completeness of the multi-QoS constraints problem, considers the link delay as the QoS constraint obligation for providing trusted routing. The major contributions of this work are: (1) New method is developed for computing trust and satisfying QoS requirement. (2) An approach to include QoS requirements and trust degree into a routing algorithm which is called as TQR is designed. (3) The TQR into the classic AODV [14] is provided.

2.11 Cross-Layer and One-Hop Neighbour-Assisted Video Sharing

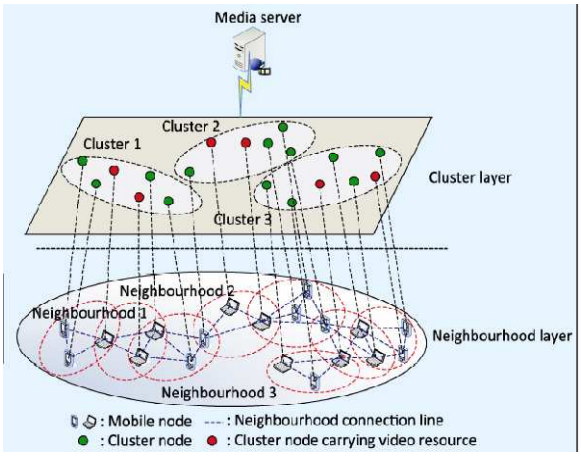

Figure 2.1 CNVS two-layer architecture

The above fig 2.1[15] describes a Cross-Layer and One-Hop Neighbor-Assisted VideoSharing (CNVS) solutionin Mobile Ad HocNetworks (MANETs). This method utilizes two-layer architecture to build the association between the geographical location of the mobile nodes and the quality of their communication channel and video content allocation. By using the cross-layer method, the information of video resource is appended into the one-hop multicast message at the MAC layer and with the help of dissemination assisted by the one- hop neighbors, the carriers of video resource and mobile nodes close to them form the resource-centric self-organization cluster structure. Every node in the network uses the cluster to discover the accessible best service source with low cost so that the overlay nodes can switch between the low and high efficiency service source in terms of their demand of Quality of Service (QoS).

Figure 2.Shows that the CNVS two-layer architecture diagram. There is a media server and multiple mobile nodes in a structure with two layers: neighborhoodlayer and cluster layer. For every mobile node, the neighborhood layer is collected of those neighboring nodes with which there is better communication quality in terms of support for multimedia data delivery. In the cluster layer, the cluster a resource centric self-organization node group without the involvement from the server.Each mobile node in the network is allocated the cluster recognition (cluster ID); the mobile nodes with the similar cluster ID form a cluster. As the original owner of video resources, the media server is familiar to all mobile nodes and gives the streaming service for the mobile nodes.

3. ANALYSIS OF QoS ROUTING MECHANISMS

S.NO	TITLE	AUTHOR	METHOD	ADVANTAGES	DISADVANTAGES
1.	Link-Stability and Energy Aware Routing Protocol in Distributed Wireless Networks	Floriano De Rango, Francesca Guerriero, Peppino Fazio	Link-stAbility and Energy aware Routing protocols	High data packet delivery ratio, less overhead	Secure communication is not achieved.
2.	Performance Evaluation of BATMAN Routing Protocol for VoIP services: a QoE perspective	Ramon Sanchez-Iborra,Maria-Dolores Cano, Joan Garcia-Haro	BATMAN protocol	Less energy consumption.	Cross-layer Techniques are not considered.
3.	QoS-Aware	Lajos Hanzo II,	QoS-aware	Improve the	Dynamic adjustment

	Routing and Admission Control in Shadow-Fading Environments for Multirate MANETs	and Rahim Tafazolli	routing (QAR) protocol	reliability	of the disjointness constraint is not addressed.
4.	Genetic Algorithm for Energy-Efficient QoS Multicast Routing	Ting Lu and Jie Zhu	Energy-efficient genetic algorithm	Less end-to-end delay and minimum energy cost.	Sharing Multicasting trees in genetic algorithm is not addressed.
5.	An Evolving Graph-Based Reliable Routing Scheme for VANETs	Mahmoud HashemEiza and Qiang Ni	Evolving graph-based reliable routing scheme	Facilitate quality-of-service	Bidirectional traffic and variable vehicular velocities are not considered.
6.	Distributed Fault-Tolerant Quality of Wireless Networks	Larry C. Llewellyn, Kenneth M. Hopkinson,and Scott R. Graham	Extended fully distributed cluster-based (EFDCB) routing protocol	High throughput, less packet loss.	High complexity.
7.	A New Distributed Application and Network Layer Protocol for VoIP in Mobile Ad Hoc Networks	Floriano De Rango, Peppino Fazio, Francesco Scarcello, Francesco Conte	Novel metric based on an objective measure of the QoS of VoIP	Reduces the probability of a block in the network to the minimum	Security is not considered.
8.	A Novel Two-Terminal Reliability Analysis for MANET	Xibin Zhao, Zhiyang You,2 and Hai Wan	Reliability analysis	High reliability is achieved.	High overhead.
9.	Optimized Multicast Routing Algorithm Based on Tree Structure in MANETs	LI Xu, LIU Tianjiao, LIU Ying, TANG Van	Multicast Ad hoc On-demand Vector with Backup Branches	Improves the network performance.	Secure communication is not achieved.
10.	A light-weight trust-based QoS routing algorithm for ad hoc networks	Bo Wang, Xunxun Chen, Weiling Chang	Trust-based QoS routing algorithm	High packet delivery ratio, less delay.	Secure routing and key management are not addressed.
11.	Cross-Layer and One-Hop Neighbour-Assisted Video Sharing Solution in Mobile Ad Hoc Networks	JIA Shijie, XU Changqiao1, Gabriel-MiroMuntean, GUAN Jianfeng1, , ZHANG Hongke1	Layer and One-Hop Neighbour-Assisted Video Sharing	Higher network throughput is accomplished.	optimizing CNVS for high speed mobility wireless networks is not addressed.

4. CONCLUSION

Quality-of-service is an important requirement in the mobile adhoc networks. A mobile adhoc network has high mobility, disputation for channel access, lack of centralized co-ordination and not reliable in nature. Due to the specific characteristics providing quality-of-service is an important consideration. So, in this survey various QoS routing mechanisms are suggested such as suggested link-stability and Energy aware Routing protocol, QoS-aware routing (QAR) protocol and an admission control (AC) protocol, Optimized Multicast Routing Algorithm etc. By analyzing these QoS routing mechanisms, it provides the idea and issues in these methods. At the end of this survey, it concludes that effectual mechanism is proposed for improving quality-of-service in the mobile adhoc networks.

REFERENCES

[1] A. Fridman, S. Weber, C. Graff, D. E. Breen, K. R. Dandekar, andM. Kam, "OMAN: a mobile ad hoc network design system," IEEETransactions on Mobile Computing, vol. 11, no. 7, pp. 1179–1191, 2012.

[2] M. Gerharz, C. de Waal, M. Frank, and P. Martini, "Link Stabilityin Mobile Wireless Ad Hoc Networks," Proc. IEEE 27th Conf. LocalComputer Networks (LCN), pp. 30-39, Nov. 2002.

[3] M. Gerharz, C. de Waal, P. Martini, and P. James, "Strategies forFinding Stable Paths in Mobile Wireless Ad Hoc Networks," Proc.IEEE 28th Ann. Conf. Local Computer Networks (LCN '03), pp. 130-139, 2003.

[4] Floriano De Rango, Francesca Guerriero, Peppino Fazio,"Link-Stability and Energy Aware RoutingProtocol in Distributed Wireless Networks,"IEEE Transactions On Parallel And Distributed Systems, VOL. 23, NO. 4, APRIL 2012.

[5] Ramon Sanchez-Iborra, Maria-Dolores Cano,andJoan Garcia-Haro,"Performance Evaluation of BATMAN RoutingProtocol for VoIP services: a QoE perspective,"IEEE Transactions on Wireless Communications,Vol. 11, No. 4, December 2012.

[6] Lajos Hanzo IIand Rahim Tafazolli," QoS-Aware Routing and AdmissionControl in Shadow-FadingEnvironments for Multirate MANETs,"IEEE Transactions On Mobile Computing, Vol. 10, No. 5, May 2011.

[7] Ting Lu and Jie Zhu,"Genetic Algorithm for Energy-Efficient QoS Multicast Routing,"IEEE Communications Letters, Vol. 17, No. 1, January 2013.

[8] Mahmoud HashemEiza and Qiang Ni,An Evolving Graph-Based Reliable RoutingScheme for VANETs,"IEEE Transactions on Vehicular Technology, Vol. 62, No. 4, May 2013.

[9] Larry C. Llewellyn, Kenneth M. Hopkinson,and Scott R. Graham,"Distributed Fault-Tolerant Qualityof Wireless Networks,"IEEE Transactions on Mobile Computing, Vol. 10, No. 2, February 2011.

[10] Floriano De Rango,Peppino Fazio,Francesco Scarcello,Francesco Conte,"A New Distributed Application and Network LayerProtocol for VoIP in Mobile Ad Hoc Networks,"IEEE Transactions on Mobile Computing, 2013.

[11] Xibin Zhao,Zhiyang You,and Hai Wan,"A Novel Two-Terminal Reliability Analysis for MANET,"Journal of Applied Mathematics,Volume 2013.

[12]LI Xu, LIU Tianjiao, LIU Ying, TANG Yan, "Optimized Multicast Routing Algorithm Based on TreeStructure in MANETs," Journal of Communications, China, Vol. 11, No.2, 2014.

[13]Bo Wang,Xunxun Chen, Weiling Chang,"A light-weight trust-based QoS routing algorithm forad hoc networks," Journal of Pervasive and Mobile Computing, Vol. 13, pp. 164-180, 2014.

[14] C.E. Perkins, E.M. Royer, Ad-hoc on-demand distance vector routing, in: Proceedings of the 2nd IEEE Workshop on Mobile Computing Systems and Applications, New Orleans, LA, Feb. 1999, pp. 90–100.

[15] JIA Shijie, XU Changqiao, Gabriel-MiroMuntean, GUAN Jianfeng, ZHANG Hongke,"Cross-Layer and One-Hop Neighbour-Assisted Video Sharing Solution in MobileAdHocNetworks,"Journal of Communications, Vol. 10, No. 6 2013.

[16] Saptarshi Batra, Soumyadeep Ghosh "MANET (Mobile adhoc networks)and routing techniques and protocols",journal publications.