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An adaptive QOS-aware Routing in MANETs

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Abstract: The use of Quality of Service (QOS) in a mobile ad hoc network(MANET) is a challenging task today due to the node mobility, contention for channel access. These difficulties are solved by using a QOS-aware routing (QAR) protocol and an admission control (AC). This paper proposes. Node mobility improved QAR and AC protocols with shadowing and varying link SINR. Maintaining backup routes for active sessions, adapting transmission rates and routing around temporarily low-SINR links can noticeably improve the reliability of assured throughput services.

Keywords: Multirate mobile ad hoc Quality of Service aware Routing; Admission Control; Shadowing; throughput.

I. INTRODUCTION

An ad hoc network [1] is a collection of wireless mobile nodes dynamically forming a temporary network without the use of any existing network infrastructure or centralized administration. This work is accomplished with QOS-aware routing (QAR) and an admission control (AC) protocol. The QAR protocol is required to find nodes with adequate resources for supporting the QOS requested by applications. It is the task of the AC protocol to estimate the residual resources of the network and to make decisions about whether new application data sessions can or cannot be admitted, given their own QOS constraints, as well as those of previously admitted sessions. A specific minimum throughput has to be maintained in most practical applications, hence in this work, we also focus on throughput-constrained data sessions. An AC protocol often has to perform a balancing act between admitting too much traffic, promising more resources, such as network capacity than are available, and thereby causing congestion, and blocking too many admission requests, thereby wasting resources that could be allocated to more users[2]. This paper contains section 2 as Proposed protocol, Section 3 as Evaluation of proposed protocol, Section 4 as Results and Discussions and Section 5 as Conclusion.

II. PROPOSED PROTOCOLS

A. StAC-backup Protocol:

First, In this paper, we describe an extended version of StAC[3], termed as StAC-backup, which exploits the knowledge of alternative or backup routes to a source's destination in order to improve the robustness of throughput-QOS assurances in the face of route failures. The StAC model[4] is summarized here. For basic routing, the features of DSR are extended. In brief, StAC utilizes three stages of AC. The first stage is the capacity-constrained route discovery, where in each node forwards the flooded route request (RReq) or the route reply (RRep) if and only if it has sufficient residual capacity to support the session. Residual capacity is estimated using the CITR. The session's capacity requirement at a particular node is expressed as its requested throughput times the protocol overhead weighting W_{req} times the contention count C_{cont}. This is expressed as

$$B_{req} = b_{req} W_{req} C_{cont}\text{, where we have,}$$

$$Wreq = (T_{DIFS} + T_{RTS} + T_{CTS} + T_{ACK} + 3T_{SIFS}) / T_{Data} + (T_{bkoff} + T_{MAChdr} + T_{lphdr} + T_{SRhdr} + T_{Data}) / T_{Data}$$

And the terms denoted by T_x represent the transmission times of the packet or header (hdr). The subscript SRhdr represents the source route header whose length depends on the route length and T_{bkoff} is the minimum amount of time that is always wasted by the 802.11 back-off algorithm before transmissions. $c_{count} = | N_{cs} \cap R_{prim} |$ where N_{cs} represents the CS neighbor set, and R_{prim} is the set of transmitter/ traffic forwarding nodes on the (potential) primary/current route of the session. The second stage of AC also performs the above test at each node by exchanging session request (SREQ) and session reply (SREP) packets between source and destination nodes along a previously discovered route.

If the SREP is received at the source node , the reliability of the route is also tested in the third stage of AC. During this stage, which lasts a few seconds, the session is partially admitted, its packet generation and transmission rate is gradually ramped up and the achievable throughput is tested along the route. Any node detecting a lower than expected throughput at any of the staggered rate stages rejects the session, informing the source node.

If the session is not rejected immediately after reaching its desired packet sending rate, it is fully admitted.

In the newly proposed protocol, once a session being admitted by StAC has found a suitable route (stage 1, see above) and its CS neighbors have been tested during the SREQ/SREP exchange (stage 2), a backup route for the session must be found. There are two possible cases. Either more than one route to the destination of the session is already known, or a backup route must be discovered.

B. StAC-multirate Protocol:

This section describes the combination of a rate-switching mechanism with a multirate 802.11[5] model and proposes a new multirate-aware version of StAC called StAC-multirate[6]. In our implementation, each node stores the rate that was last used for transmission to each of its neighbors with which it has communicated, as well as the numbers of contiguous missed or received ACKs. Since the transmission rate is likely to change multiple times per second, following the fluctuations due to shadowing, it is impractical to report every change to the network layer protocols. Instead, the rate in use by each packet is recorded, and the average rate is calculated in a 1 s sliding window. This average rate is rounded off to the nearest supported rate, which is reported to the routing protocol when it queries that particular link rate. Note that despite the different transmission ranges achieved by the different modulation schemes, the optimal CS range does not vary . Therefore, a fixed CS range is maintained for simulations in this work.

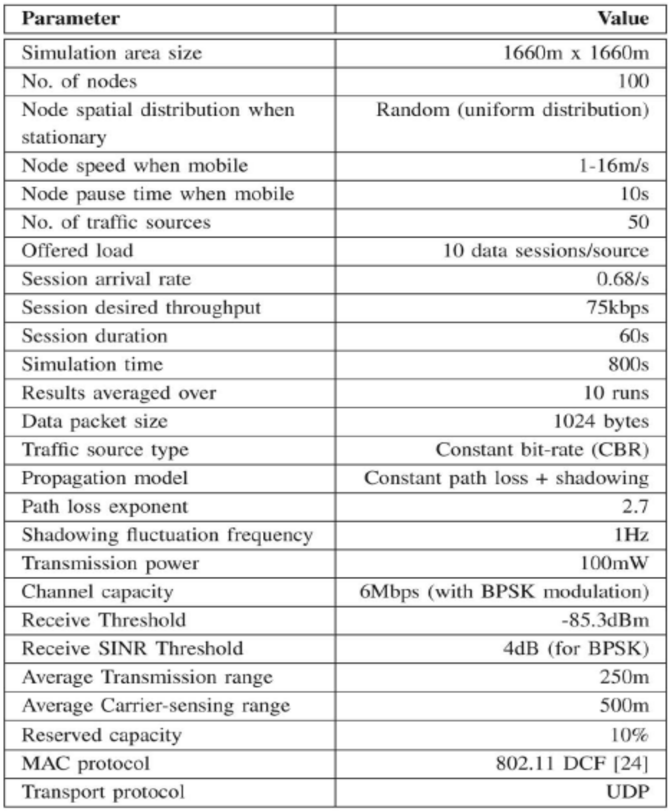
C. StAC multirate-backup Protocol:

The StAC-backup protocol, proposed and the StAC-multirate protocol, described above, can have their features combined into a protocol, we call the StAC multirate- backup protocol.

III. EVALUATION OF PROPOSED PROTOCOL

Simulation Parameters Employed for the Comparative Study of the Proposed AC and QoS Aware Routing Protocols

Table 1 Simulation parameters employed for the comparative Study of the proposed ac and qos aware routing protocols



Parameter	Value
Simulation area size	1660m x 1660m
No. of nodes	100
Node spatial distribution when stationary	Random (uniform distribution)
Node speed when mobile	1-16m/s
Node pause time when mobile	10s
No. of traffic sources	50
Offered load	10 data sessions/source
Session arrival rate	0.68/s
Session desired throughput	75kbps
Session duration	60s
Simulation time	800s
Results averaged over	10 runs
Data packet size	1024 bytes
Traffic source type	Constant bit-rate (CBR)
Propagation model	Constant path loss + shadowing
Path loss exponent	2.7
Shadowing fluctuation frequency	1Hz
Transmission power	100mW
Channel capacity	6Mbps (with BPSK modulation)
Receive Threshold	-85.3dBm
Receive SINR Threshold	4dB (for BPSK)
Average Transmission range	250m
Average Carrier-sensing range	500m
Reserved capacity	10%
MAC protocol	802.11 DCF [24]
Transport protocol	UDP

In this paper the original version of StAC is compared to both StAC-backup and StAC-multirate as well as to the combination of both protocols into a single protocol: StAC-multirate-backup. The popular ns-2 simulation platform8 (version 2.33) was employed for all simulations in this paper.

IV. SIMULATION MODEL

A. Phy and MAC:

While ns 2 includes a shadowing model, it produces completely uncorrelated shadowing attenuation values, varying instantaneously in time. This is unrealistic, since objects in the real world causing shadowing travel at a finite velocity through space, if at all[7]. Thus, in this work, we utilize a shadowing model exhibiting realistic temporal correlation. Assuming a shadowing standard deviation of 6 dB, this means that 95 percent of the time the range falls within 12 dB of the mean, which translates to instantaneous ranges between 94 m and 726 m, using the parameters of Table.

B. Mobility:

Here two different scenarios are used one with mobile nodes one static nodes. The shadowing standard deviation is varied in both cases. When the nodes themselves are not moving, and hence, their relative topology is constant, the shadowing attenuation is still assumed to vary due to cars, and buses moving around them[8].The static case with 0 shadowing standard deviation (constant path loss ,deterministic transmission range) shows the best possible performance for the given topology.

C. Network layer Protocol Modelss:

The third AC stage of StAC and of all of the proposed protocol lasted 5s, which was split into 5 stages, each allowing a packet generation rate that was higher than in the previous 1s by 1/5th of the sessions requested throughput. For this study , we reserve a certain 10 percent of channel access time , i.e., the CITR is reported to be 0.1 less than its actually measured value. Note that all protocols select the first discovered route for initial session admission.

D. Application Layer:

In StAC, the application's setup process is modeled as in the second and third stages of AC.However, note that SREQ/SREP packets may not be salvaged if their route fails. A 10 s session blocking timer is utilized for all protocols. During this time, they may search for routes as often as allowed by DSR's RReq back off mechanism and the SREQ is resent once during this period in case the first one is lost. If, after 10 s the session has not been admitted, it is blocked.

V. SIMULATION MODEL

The metrics are concerned with the protocols' capacity utilization efficiency.

A. Evaluation Metrics:

a. ***Session Admission Ratio (SAR):-***The total number of admitted sessions divided by the number of session admission requests. This metric provides a relative measure of a protocol’s AC stringency. It also indirectly represents the level of network capacity utilization, since a higher SAR usually translates to a higher network utilization.

b. ***Session Rejection Ratio*****:-** The total number of blocked sessions divided by the number of session admission requests.

c. ***Packet Loss Ratio (PLR)*****:-** The fraction of generated application layer data packets that were not delivered to their destination node.

VI. RESULTS AND DISCUSSIONS

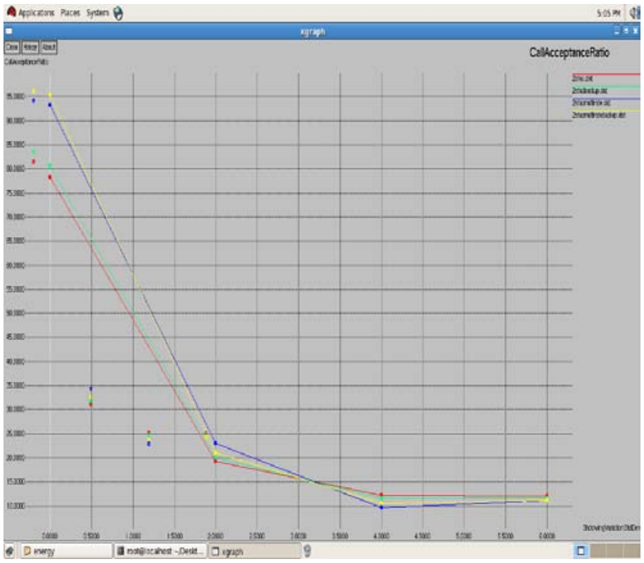


Figure 1: The session admission ratios in a network of static nodes versus the shadowing variation standard deviation. Simulation parameters employed are summarized in Table.

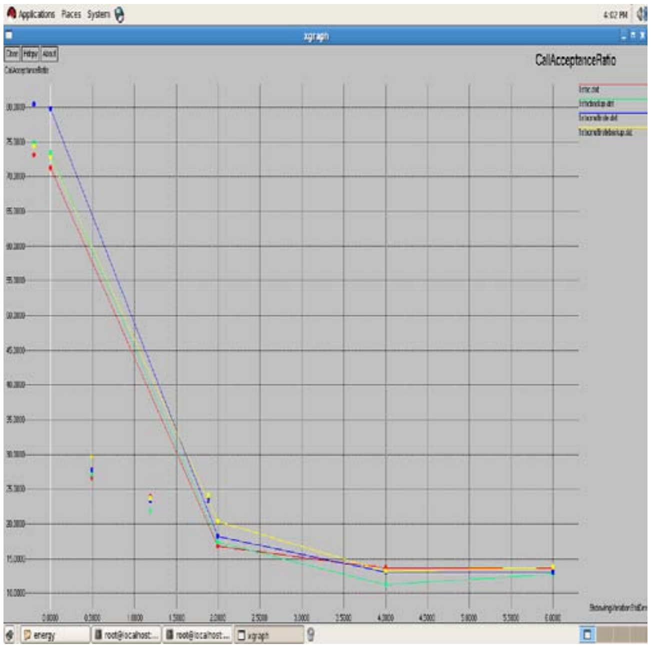


Figure 2: The session admission ratios in a network of mobile nodes versus the shadowing variation standard deviation. Simulation parameters employed are summarized in Table.

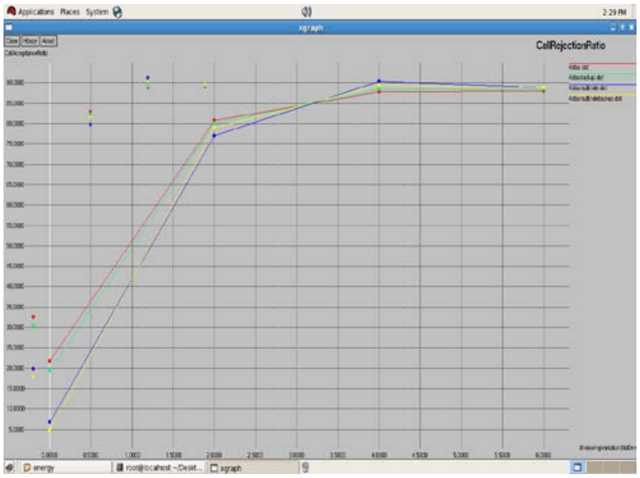


Figure 3: The session rejection ratios in a network of static (left) nodes versus the shadowing variation standard deviation. Simulation parameters employed are summarized in Table.

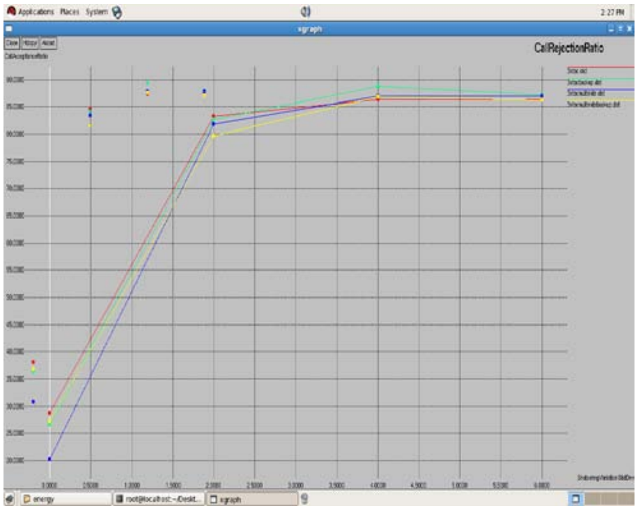


Figure 4: The session rejection ratios in a network of mobile nodes versus the shadowing variation standard deviation. Simulation parameters employed are summarized in Table.

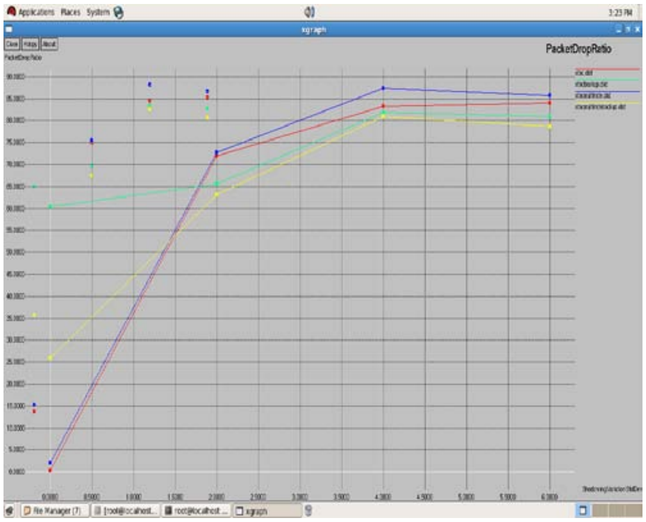


Figure 5: The average data packet loss ratio experienced in a network of static nodes versus the shadowing variation standard deviation. Simulation parameters employed are summarized in Table.

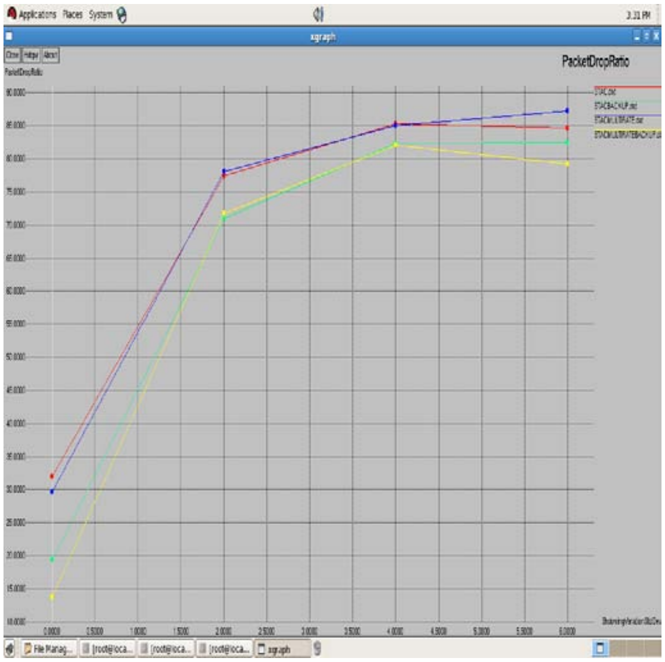


Figure 6: The average data packet loss ratio experienced in a network of static nodes versus the shadowing variation standard deviation. Simulation parameters employed are summarized in Table.

Figure1and 2 shows the achieved SAR with various degrees of shadowing for both static and mobile nodes for the four versions of StAC listed above. Unsurprisingly, the SAR decreases with increasing shadowing variance for all versions. This is chiefly due to the lower throughput requirements being upheld during the third stage of AC owing to the fluctuating link quality. From the figure we can observe that in the case of static nodes, the advantage of a higher SAR with the rate switching employing and multirate aware AC becomes more apparent, since mobility does not add to the route failure probability during the third stage of StAC's AC process. The multirate versions of StAC are also able to admit more sessions, since they are more likely to maintain the required throughput during AC by switching to 0 bps mode for temporally low quality links and routing around them. Fig. 3 and 4 , the difference between the protocols is not significant when the shadowing fluctuation is mild, especially for static nodes. This is due to the relative scarcity of link failures. In general, all of the advanced versions of StAC perform better than the original version as a benefit of backup routes or the ability to route around bad links. The results also indicate that usage of end-to- end route redundancy (StAC-backup and StAC-multirate- backup) is more effective with high shadowing variance, than the use of adaptive modulation and local rerouting alone.

VII. CONCLUSION

This paper proposed several new protocols, related to the StAC protocol, and evaluated their performance in the face of increasingly severe shadowing attenuation fluctuations. First, the StACbackup protocol added a feature that attempts to provide a pre-capacity-tested backup route to each active data session. Use of such backup routes allowed the elimination of "available capacity" status update packets used by StAC while reducing the risk of rerouting to routes for which there is no knowledge of their free capacity. However, it was found that with severe shadowing induced signal strength fluctuations, the pretesting of backup routes was less significant, although merely proactively seeking backup routes still improved the achieved QoS.

Second, the StAC-multirate protocol adds multiple link transmission rate awareness to the AC [9]and routing process, as well as features to route around temporarily low-quality links. Adaptive modulation enables higher SINR links to be exploited by StAC-multirate for admitting more traffic, as well as facilitating the adaptation of the packet reception probability to the shadowing-dependent time variant link quality.

The achieved SAR, as well as the throughput QoS, are both high with the studied protocols when shadowing fluctuations are not severe, it can be concluded that the network capacity is sufficient to support the admitted amount of traffic. The fact that a decreasing amount of traffic is admitted by the proposed protocols as the shadowing fluctuation severity increases shows that much less of the network's capacity can be exploited by throughput-sensitive sessions. the throughput QoS of admitted sessions can be significantly imporved by the proposed protocols compared to the previously proposed StAC protocol.

VIII. REFERENCES

[1]. Maamar Sedrati,Azed Bilami,Mohamed Benmohamed "M-AODV: AODV variant to Improve Quality of Service in MANETs" International Journal of Computer Science issues,January 2011.

[2]. L. Kleinrock and J. Silvester, "Spatial Reuse in Multi-Hop Packet Radio Networks," Proc. IEEE, vol. 75, no. 1, pp. 156-167, 1987.

[3]. L. Hanzo II and R. Tafazolli, "Admission Control Schemes for 802.11-Based Multi-Hop Mobile Ad Hoc Networks: A Survey,"IEEE Comm. Surveys and Tutorials, vol. 11, no. 4, pp. 78-108, Oct.-Dec. 2009.

[4]. L. Hanzo II and R.Tafazolli, "Throughput Assurances through Admission Control for Multi-Hop MANETs," Proc. IEEE Int'l Symp. Personal, Indoor and Mobile Radio Comm. (PIMRC'07),pp. 1-5, Sept. 2007.

[5]. IEEE Std. 802.11-2007, Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications, IEEE, 2007.

[6]. L. Hanzo II and R. Tafazolli, "Ch 3: Mobile Ad Hoc Networks:Challenges and Solutions for Providing Quality of Service Assurances,"4G Mobile and Wireless Comm. Technologies, S. Kyriazakos, Soldatos, and G. Karetsos, eds., pp. 31-43, River, 2008.

[7]. L. Chen and W. Heinzelman, "QoS-Aware Routing Based on Bandwidth Estimation for Mobile Ad Hoc Networks,"

[8]. W. Navidi and T. Camp, “Stationary Distributions for the RandomWaypoint Mobility Model,” IEEE Trans. Mobile Computing, vol. 3,no. 1, pp. 99-108, Jan. 2004.

[9]. Y. Yang and R. Kravets, “Contention-Aware Admission Control for Ad Hoc Networks,” IEEE Trans. Mobile Computing, vol. 4, no. 4,pp. 363-377, July/Aug. 2005.