Bandwidth management for QoS in MANETs using Flow Aware Admission Control Protocol

Dr Srinivasa Gowda GK Dr sunil Jacob

Abstract-

The development and availability of cheap wireless Wi-Fi devices enables usage of MANET supported applications and the subsequent widespread acceptance. A novel protocol Flow-Dependent- Admission Control (FDAC) protocol is designed to improve the throughput assurance of MANET-based applications. The main contribution of this research is to guarantee the provisioning of QoS in many mobile scenarios. The transmission node is designed to maintain multiple paths to each destination with the reliability of the routes maintained through nodes disjointness. The devised FDAC-Multipath protocol consists intermediate route repair mechanism to enable the intermediate node to carry out route repair locally without contacting the source node. We have presented the effectiveness of FDAC Multipath with the state of the art admission control protocols.

Keywords: MANETs, QoS, Multipath

I. INTRODUCTION

The initial use of multimedia applications in almost every walk of life also encourages MANETs to support services in terms of provisioning of guaranteed throughput, delay, packet delivery ratio, delay jitter etc [1, 2]. Quality of Service (QoS) provisioning in MANETs is a challenging task due to lack of centralized control, lower shared capacity and error prone wireless medium as well as unpredictable dynamic topology amongst others. On demand routing protocols used for best effort services has to be adapted in a way that will assure QoS-provision. This research mainly focuses on the adding of multipath routing and route repair functionality to our proposed FDAC protocol [3]. The FDAC-Multipath protocol maintains multiple paths from source to destination with all paths stored at the source node of the data. One path used for transmission of data traffic is selected as primary while other paths are selected as secondary paths. To maintain the validity of the secondary paths, the protocol checks their validity after a regular period. FDAC-Multipath protocol switches the data traffic from one route to another in case of route failure. FDAC-Multipath protocol increases bandwidth and minimizes delay due to the absence of session pausing mechanism found in other protocols like CACP and PAC [4, 5].

II. LITERATURE REVIEW

Due to the non-availability of alternate path in routing protocol, the packets of the current data traffic are dropped in case of route failure. In [6], an Adaptive QoS routing protocol (ADQR), traffic is sheared between multiple paths to fulfil the requirements of the data traffic. The traffic is distributed among different paths which give rise to inherent problem of packet reordering at the destination node. Interference-aware QoS Multipath Routing (IMPR) [7,8] protocol proposes the combination of disjoint routes based on available bandwidth and link stability, but does not specify how the computation is carried. Scalable Multipath on Demand Routing protocol (SMORT) improves path reliability by providing intermediate nodes with multiple routes to each destination [9]. Route stability-based multipath QoS routing (SMQR) considers each node‟s individual bandwidth and does not consider any effects on the neighbour„s capacity[9]. So it may underestimate or overestimate the capacity while granting admission to new data sessions. In [11], MACMAN introduces to use multiple paths with the Admission Control for provisioning of QoS. It considers fully disjoint multiple paths between source and destination which is very difficult to maintain in scenario like MANETs.

Furthermore, all studied multipath routing protocols have a reasonable amount of path dissemination problem [12].

III. FDAC-Multipath

it is the extended version of our designed FDAC [3] protocol. The protocol maintains multiple paths and intermediate nodes are able to recover the route repair by themselves. Here we described the main additional functions of the basic FDAC protocol that forms FDAC-Multipath protocol.

A. Selection of Backup routes:

During the route discovery process, the nodes capacities are not tested. The source stores all the received RReps from destination and tests the capacity of first found route from source to destination. For backup route, local capacity is tested using Channel Idle Time Ratio (CITR) mechanism while neighbour"s capacity is tested passively by having lower carrier sensing threshold. Contention Count (Ccount) may underestimate or overestimate the capacity because FDACMultipath supports partially disjoint routes, which means that backup and primary route may share some nodes as well as Carrier Sensing Range (CSR), so instead of Contention Count, FDAC-Multipath will use Contention Difference (CD). The CD of a node is the number of those carrier sensing neighbours excluding destination node which are on backup path but not on the current path of the data flow. CD is estimated as:

$$CD = |C_{\text{count}}| - |CSN \cap R_{\text{arr}} \setminus \{D\}| \quad \text{----------(1)}$$

Here Ccount, CSN, Rcurr and D represent contention count, carrier sensing range, current route and destination.

B. Reliability of Backup route:

The protocol uses partially disjoint routes so that the probability of concurrently routes failure may be minimized. The primary and backup routes can share half of the route nodes. The following equation finds the reliability of the backup route by comparing the available bandwidth with the required bandwidth of the data flow.

$$Bavil - B_{rsv} >= CD^{*} B_{req} \quad \text{----------(2)}$$

Here Bavail, Brsv and Breq represent available, reserve and required capacity.

C. Maintenance of Backup route:

FDAC-Multipath protocol has one primary and one tested backup path for each data session and data is always transmitted on primary path. Source node may have stored more untested backup path for the same data session. If primary path fails, the flow is switched to the tested backup route without pausing the data session. When route failure occurs at any node, the node tries to recover the route locally. By local repairing, we mean that the error finding source node will search for an alternate route, which can fulfil the requirements of that flow. When all the cached backup routes are removed, then the source set off new route discovery for the same data session. The source node initiates the backup route discovery by transmitting route request multipath (RReq-Multipath) packet with disjointness condition.

IV. SIMULAITON ENVIROMENT

FDAC-Multipath protocol is evaluated through extensive set of simulations under different network load using NS-2. We compared FDAC-Multipath with CACP, MACMAN and FDAC protocol to check its Admission Control capability with both the protocols.

V. SIMULATION RESULTS ANALYSIS

CACP and MACMAN do not consider increase in collision due to arrival of new data sessions. Hence the data packets are dropped more frequently. PLR of CACP and MACMAN change from 1.6% to 3% and from 1.5% to 3.4% respectively as the load increases. Due to higher PLR, CACP and MACMAN

congested the network and sessions did not complete. This contributes to higher delays in packet delivery and low throughput of the network. The PLR of FDAC and FDAC-multipath is lower than CACP and MACMAN due to the careful admission of data session and thoroughly checking the affect of new data session on earlier admitted data sessions. This contributes to higher completion ratio, higher throughput and lower delay. Link failure is repaired locally and multiple paths reduce the need of route discovery. The FDAC-multipath introduced more overhead than FDAC but less than MACMAN.

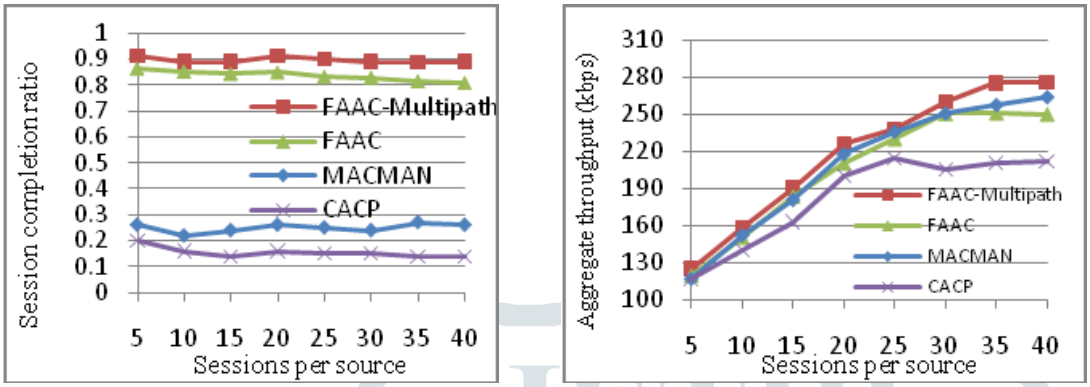

Figure 1 Session Completion Ratio and throughput

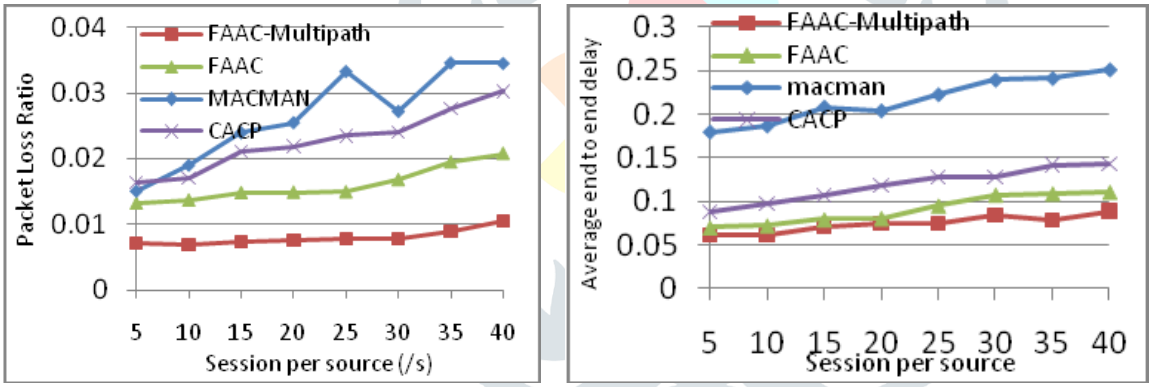

Figure 2 Packet Loss Ratio and Average end to end Delay

VI. CONCLUSION

The simulation results show that backup and local route repair capability has improved the data completion ratio by almost 10% and throughput is improved by 15%.

REFERENCES

[1] M.Asif, Z.Sun and Haitham Cruickshank, " Admission control protocols in mobile ad hoc networks provisioning QoS," In Proceedings of the 7th ACM International Conference on Frontiers of Information Technology , 2009.

[2] S.Basagni, M.Conti, S.Giordano and I.Stojmenovic. Mobile ad Hoc Networking. Wiley-IEEE,2004. [3] M. Asif, Z.Sun, H.Cruickshank and N.Ahmad, "QoS provisioning in contention aware MANETs using Flow-Aware Admission Control protocol," IADIS, TNS Italy, July 2011.

[4] Y.Yang, and R.Kravets, "Contention-aware admission control for ad hoc networks," In IEEE Transaction on Mobile Computing, vol. 4, no. 4, pp. 363-377, Aug 2005.

[5] Ian D. Chakeres, Elizabeth M. Belding-Royer and Joseph P. Macker, "Perceptive admission control for wireless network quality of service," Ad Hoc Networks, Volume 5, Issue 7, pp. 1129-1148, Sep. 2007.

[6] Y.Hwang and P. Varshney. " An Adaptive QoS Routing Protocol with Dispersity for Ad-hoc Networks, " Proc of the 36th Hawaii Int. Conf. on Sys. Sci. (HICSS"03), pp-302-11,2003.
[7] Y.H. Wang, C.H.Tsai, H.Z.Lin and C.A. Wang. " Interference aware QoS Multipath Routing for Ad Hoc Wireless Networks, " Int. J.Com.App., vol.29, Issue 4,2007

[8] abu bakar, Kamalrulnizam. "Interference-Aware Multipath Routing Protocol for QoS Improvement in Event-Driven Wireless Sensor Networks." Tsinghua Science & Techn (abu bakar, 2011)

[9] L. R. Reddy and S.V. Raghavan. "SMORT: Scalable Multipath on Demand Routing in Mobile Ad Hoc Networks, " Ad. Hoc. Networks., vol.5, no. 2,pp. 162-88, March 2007.
[10] N. Sarma and S.Nanda, " A Multipath QoS Routing with Route Stability for Mobile Ad Hoc Networks," IETE Tech. Review, vol., 27, no. 5, pp.380-97,Sep-Oct 2010.
[11] A. Lindgren, Elizabeth M. Belding-Royer, "Multi-path admission control for mobile ad hoc networks," Mobile and Ubiquitous Systems: Networking and Services, 2005. MobiQuitous 2005. The Second Annual International Conference on , vol., no., pp. 407- 417, 17-21 July 2005
[12] A.M. Abbas and B. N. Jain, " Mitigating path diminution in disjoint multipath routing for mobile ad hoc networks, " Int. J. Ad Hoc and Ubiquit. Comp., vol. 1, no. 3,pp. 137-46, 2006.