Multiparametric Approach To Perform QoS Analysis Of Mobile Ad-Hoc Network

Rahul Kumar, Ritu Pahawa

Abstract— **Wireless ad-hoc networking has become an irreplaceable technology in modern communication system where communication infrastructure is insufficient or unavailable. Ad-hoc network is a collection of self-organizing nodes that are rapidly deployable and adaptable to frequent topology changes. The evolution of the Multimedia Technology & the Commercial Interest of Companies to reach civilian applications has made QoS in MANETs an unavoidable task. Resource limitations and variations add to the need for QoS provisioning. Use of MANETs in critical and delay sensitive applications demands service differentiation. Maintaining appropriate Quality of Service (QoS) for MANETs is a complex task due to the dynamic behavior of the network topology. The goal of QoS provisioning is to achieve network behaviors that are deterministic, so that information carried by the network can be better delivered and network resources can be better utilized. In this paper, we are going to analyze the multiparametric approach to perform QoS analysis of mobile ad-hoc network.**

Index Terms*— *MAC, MANET, QoS

I. MANET FEATURES

Mobile ad-hoc network (MANET) is wireless ad-hoc network in which mobile routers and associated hosts got configured by itself [1]. Local network with associated wireless and temporary plug-in connection are the part of network when they are closely associated with the network. The MANET topology is arbitrary and dynamic [2]. Network topology may change regularly and at unpredictable times. Routers freely move randomly and organize themselves arbitrarily. MANETs do not have fixed infrastructure. Mobile nodes in these networks act as both host and router, and communicate each other with packet radios.

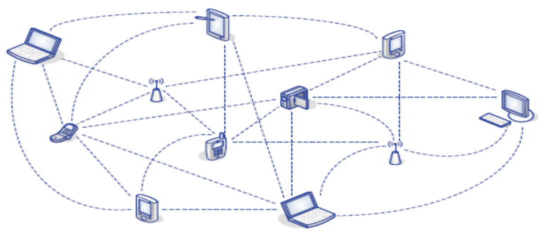

Figure.1 mobile ad hoc network

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Typically, MANET has the following features [3] [4]: Autonomous terminal, Distributed operation, Multi-hop routing, Dynamic network topology [5], Fluctuating link capacity [6] and Light-weight terminals. These features create a set of assumptions and performance concerns for protocol design which extend beyond routing design guide within higher-speed and semi-static topology of the fixed Internet.

II. QUALITY OF SERVICE (QOS) [9]

For a network QoS is the guaranteed amount of data transfer from one place to another during a certain time. The QoS can be defined in terms of set of service requirements met by the network during packet transmission. The collective effect of service performance determining degree of user satisfaction is QoS. The QoS metrics can be defined in terms of certain parameters; such as bandwidth requirement, delay occurred, packet loss probability, and delay variance (gitter). Based on particular application, the end user requirements need to meet during packet transportation. There are certain issues and difficulties faced in these ad-hoc networks that result in consideration of certain QoS provisions in the networks. These issues and difficulties are: unpredictable link properties, node mobility, bandwidth constrains, limited processing and storing capabilities of the device, limited battery life, hidden terminal problem, exposed terminal problem, route maintenance and security. QoS provisions are not to extinct overhead but to keep it as low as possible. QoS and Overhead are interlinked and work on expense of each other.

A. Acheive Qos

QoS achievement is must for today and future era of wireless communication. QoS can be achieved by

1. Over Provisioning

By adding plentiful capacity to the network, QoS can be achieved. This methodology is easy and can be done gradually but this is not practically feasible. Here we will attain QoS at the expense of other factors and will remain at best effort terminology.

2. Network Traffic Engineering

Network traffic engineering is more feasible methodology to attain QoS in network. By making network more sophisticated, we can achieve QoS. Network sophistication can be achieved by defining network classes, connection admission control and by efficient management of the network. Reservation based engineering scheme i.e integrated service (IntServ) helps in achieving QoS rather it is a network consuming process. Here huge storage capacity and processing overhead for each host are used to maintain flow rate information. Reservation less engineering scheme i.e differentiated service (DiffServ) is light weight model since individual flows are aggregated.

III. COMPROMISING PRINCIPLES

QoS achievement is based on two basic principles. The two principles are Soft QoS and DYNAMIC QoS [7]. In SOFT QoS, after connection is set up, there may exist transit period of time when QoS specification is not honored. The level QoS satisfaction is quantified by the fraction of total disruption. In DYNAMIC QoS, when available resources change, the network can readjust allocations within the reservation range. Applications can also adapt to the re-allocations.

IV. PARAMETERS TO PERFORM QoS ANALYSIS

There are a lot of factors that affect the QoS provisioning in MANET. These factors are physical layer connections, medium access control, routing protocols, transport factors, bandwidth constraints, node variability and energy constraints.

B. Physical Layer Connections [11]

Limited wireless range and shared frequency space leads to specific mobile ad hoc problems. Due to physical layer connections, there are high risk of collisions and packet losses because ad-hoc network uses contention based approach to access media. Collision risk and packet loss is due to the fact that not only are the wireless network Nodes communicating on the specified wireless frequency but other non network nodes may also be using this same frequency generating additional noise reducing the ability of the MANET to pass traffic. Due to physical layer connections, there are hidden and exposed terminal problems.

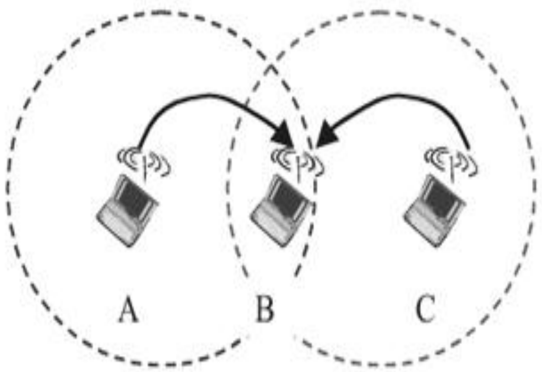

Figure 2: Hidden Terminals

Figure 2 shows node A wishes to communicate with B. However A cannot detect communication from C but can detect communication from B. C also wishes to communicate with B. Again C cannot detect communication from A but can detect Communication from B. C is hidden from A and A is hidden from C.

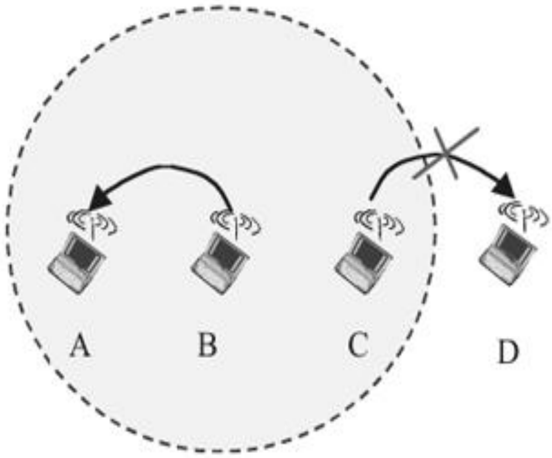

Figure 3: Exposed Terminals

Figure 3 shows nodes A, B, and C can all detect communications from one another. However, Only C can detect communication from D. Node B wishes to send to Node A and Node C wishes to send to Node D. So Node B begins transmitting to Node A and Node C recognizes this. The medium is in use so Node C can not transmit to Node D. Even though both transmission requests could be made going in opposite directions without great risk of collisions the transmission does not happen. This is because Node C is exposed to Nodes A and B while D is not.

C. Medium Access Control [12]

There are some medium access problems in wireless networks. The signal strength decreases proportional to the square of distance. Sender would apply carrier sense (CS) and collision detection (CD) but collisions happen at receiver side, If terminal is hidden CS and CD fails. So in order to avoid collision, MACA (multiple access with collision avoidance) is used which uses signaling packets for collision avoidance. The signaling packets used are request to send (RTS) and clear to send (CTS).These signaling packets have receiver address, sender address and packet size. MACE avoids the problem of hidden terminals and exposed terminals. To achieve reliability, acknowledgements are used.

D. Routing Protocols [10]

A *routing protocol* sets up a *routing table* in *routers*. There are certain issues that act as barrier in QoS provisions. Frequent route changes amount of data transferred. Route changes may be related to host movement. We have to achieve some goals of routing protocols for better QoS provisions. These goals are to decrease routing related overhead and to find short and stable routes.

E. Transport Factors

Wireless transmission errors may cause fast retransmit which results in retransmission of lost packets and reduction in congestion window. Reduction in congestion window in response to errors is necessary. Longer connections are at disadvantage compared to shorter connections, because they have to contend for wireless access at each hop. TCP throughput decreases with increase in number of hops [8].

F. Bandwidth Constraints

In MANETs, the bandwidth used is of wide range capacity and in general more prone to errors. On the other hand, the lower capacity wireless links lead to higher congestion problems. Physical security is very low in wireless links. The overhead to deal with the problems reduces the available bandwidth for user applications. The lower throughput capacity to carry the same data leads to congestion problem.

G. Node Variability [8]

Node mobility causes link breakage resulting in route failure. The time during which route is repaired; TCP sender times out and starts sending packet again.TCP throughput decrease with increase in mobility. The variation in node link capabilities can greatly affect the performance and operation of the MANET. The key goal is to be heterogeneous so that any mobile device can connect to the MANET smoothly and seamlessly. Other items affecting this notion include changing power levels, changing channel conditions, traffic load and distribution, load balancing options, congestion, and general service environments.

H. Energy Constraints

The nature of mobile devices is to operate from battery power. Such power is limited which in turn limits services and applications that the network can support. Because each node is already services wireless links, operating as an end system, and operating as a router the power drain is quicker and thus supported services are further hindered. Minimizing routing paths reduces power needed to send a packet end-to-end. Transmit power levels can greatly affect the ability of the network to control congestion.

V. CONCLUSION

QoS in MANETs is rapidly increasing area of interest. The effort of providing QoS in MANETs is difficult. A complete QoS provision requires an appropriate QoS model, signaling protocol, routing protocol, MAC protocol, various supplementary mechanisms as policy managers and queuing mechanisms for congestion control and others. Link adaptation in physical layer, channel access coordination and admission control strategies in MAC layer are possible QoS provisioning classification. QoS routing is key issue in provision of QoS in ad-hoc networks. There are some open issues that affect QoS provisioning like physical layer connections, transport factors, bandwidth constraints, node variability, energy constraints, scheduling mechanisms and integration / coordination with MAC layer.

REFERENCES

[1] G. O. Young, "Synthetic structure of industrial plastics (Book style with paper title and editor)," in *Plastics*, 2nd ed. vol. 3, J. Peters, Ed. New York: McGraw-Hill, 1964, pp. 15–64.

[2] W.-K. Chen, *Linear Networks and Systems* (Book style). Belmont, CA: Wadsworth, 1993, pp. 123–135.

[3] H. Poor, *An Introduction to Signal Detection and Estimation*. New York: Springer-Verlag, 1985, ch. 4.

[4] B. Smith, "An approach to graphs of linear forms (Unpublished work style)," unpublished.

[5] E. H. Miller, "A note on reflector arrays (Periodical style—Accepted for publication)," *IEEE Trans. Antennas Propagat.*, to be published.

[6] J. Wang, "Fundamentals of erbium-doped fiber amplifiers arrays (Periodical style—Submitted for publication)," *IEEE J. Quantum Electron.*, submitted for publication.

[7] C. J. Kaufman, Rocky Mountain Research Lab., Boulder, CO, private communication, May 1995.

[8] Y. Yorozu, M. Hirano, K. Oka, and Y. Tagawa, "Electron spectroscopy studies on magneto-optical media and plastic substrate interfaces(Translation Journals style)," *IEEE Transl. J. Magn.Jpn.*, vol. 2, Aug. 1987, pp. 740–741 [*Dig. 9th Annu. Conf. Magnetics* Japan, 1982, p. 301].

[9] M. Young, *The Techincal Writers Handbook*. Mill Valley, CA: University Science, 1989.

[10] (Basic Book/Monograph Online Sources) J. K. Author. (year, month, day). *Title* (edition) [Type of medium]. Volume(issue). Available: http://www.(URL)

[11] J. Jones. (1991, May 10). Networks (2nd ed.) [Online]. Available: http://www.atm.com

[12] (Journal Online Sources style) K. Author. (year, month). Title. *Journal* [Type of medium]. Volume(issue), paging if given. Available: http://www.(URL)

[13] R. J. Vidmar. (1992, August). On the use of atmospheric plasmas as electromagnetic reflectors. *IEEE Trans. Plasma Sci.* [Online]. *21(3)*. pp. 876—880. Available: http://www.halcyon.com/pub/journals/21ps03-vidmar

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