Quality of Service in MANET

Seema
Department of Computer Science Engineering
U.I.E.T (MDU), Rohtak, Haryana, India

Dr. Yudhvir Singh
Department of Computer Science Engineering
U.I.E.T (MDU), Rohtak, Haryana, India

Mr. Vikas Siwach
Department of Computer Science Engineering
U.I.E.T (MDU), Rohtak, Haryana, India

Abstract: Quality of service (QoS) in Mobile Ad-hoc Network (MANET) which is universally growing area. A mobile ad-hoc network is a collection of mobile devices which form a communication network with no pre-existing infrastructure. Due to rapid expansion of multimedia technology, mobile technology and real time applications has need to strictly support quality of service such as throughput, delay, energy consumption, jitter etc. This paper presents the description about the QoS.
Keywords: MANET, QoS, ad-hoc networks

I. INTRODUCTION

The current Internet architecture supports best-effort data delivery by default, which has provided satisfactory services for various applications, such as the email and file transfer, to a great extent. On the other hand, the increase in real-time multimedia applications such as Voice over IP, audio and video streaming in the public Internet demand for a Quality of Service (QoS) routing. Quality of Service (QoS) is usually defined as a set of service requirements that need to be met by the network while transporting a packet stream from source to destination. With the increasing needs of QoS provisioning for evolving applications such as real-time audio/video, it is desirable to support these services in ad hoc networking environments. The network is expected to guarantee a set of measurable specified service attributes to the user in terms of end-to-end delay, bandwidth, probability of packet loss, energy and delay variance (jitter).

II. QUALITY OF SERVICE

The quality of service (QoS) refers to several related aspects of telephony and computer networks that allow the transport of traffic with special requirements.
In the field of telephony, quality of service was defined by the ITU in 1994. Quality of service comprises requirements on all the aspects of a connection, such as service response time, loss, signal-to-noise ratio, cross-talk, echo, interrupts, frequency response, loudness levels, and so on. A subset of telephony QoS is grade of service (GoS) requirements, which comprises aspects of a connection relating to capacity and coverage of a network.
In the field of computer networking, QoS is the ability to provide different priority to different applications, users, or data flows, or to guarantee a certain level of performance to a data flow.
Quality of service guarantees are important if the network capacity is insufficient, especially for real-time streaming multimedia applications, since these often requires fixed bit rate and are delay sensitive and in network where the capacity is a limited resource.

III. LAYERED ARCHITECTURE OF QoS

The layered view/architecture of quality of service contains 3 parts

- User
- Application

- Network

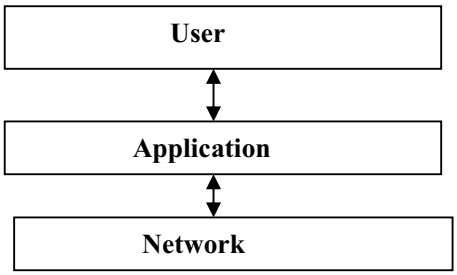

Figure 1: Layered view of QoS

Application layer QoS

This layer explain how well user expectations are qualitatively satisfied such as clear voice (mean opinion scoring), jitter –free video, etc. This layer also describes arrival pattern and sensitivity to delivery delays. End-to-end protocols (RTP/RTCP), application-specific representations and encoding (FEC, interleaving) are implemented at this layer.

Table 1: Application arrival pattern in terms of relative predictability

Rate type	Description
Stream	Predictable delivery at a relatively constant bit rate (CBR) – e.g. audio
Burst	Unpredictable delivery of data at a variable bit rate (VBR). E.g., MPEG which move data in bulk.

Network layer QoS

This layer four quality factors:

- Bandwidth - the rate at which an application's traffic must be carried by the network.
- Latency - the delay that an application can tolerate in delivering a packet of data.
- Jitter - the variation in latency.
- Loss - the percentage of lost data.

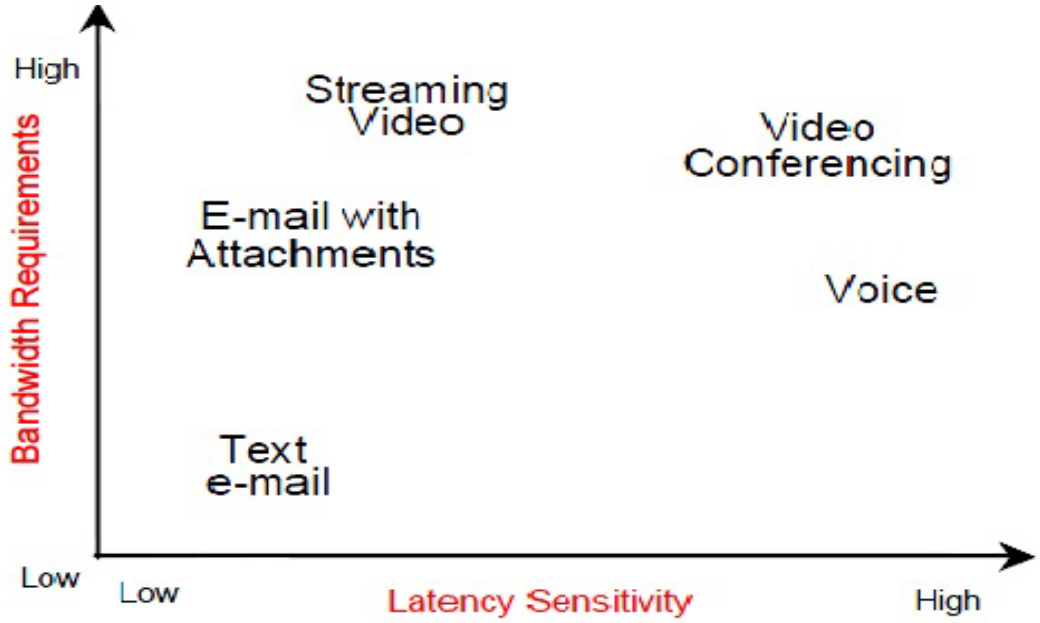

Figure 2: Different Applications and Network Requirements

IV. QoS CONSTRAINTS

The QoS requirement of an application is given as a set of constraints, which can be link constraints or path constraints. A link constraint specifies the restriction on the use of links. A path constraint specifies the end-to-end QoS requirement on a single path. Each link in the network is associated with multiple parameters that can be roughly classified into additive and non-additive constraints.

- Additive constraints / Time Constraints

Examples: Delay, Delay variation (jitter), and Cost.

- Concave/convex Constraints / Frequency Constraints

Examples: Bandwidth (here bandwidth is the residual bandwidth that is available for network flow).

- Multiplicative Constraints

Example: Loss probability

- Space Constraints

Example: System Buffer

- Reliability Constraints

Example: Error Rate

V. TYPES OF QoS PROVISION

In networking two type of services

- Integrated services
- Differentiated services

a) Integrated Services

An integrated service provides closest circuit emulation on IP networks. Network resources are apportioned according to an application's QoS request, and subject to bandwidth management policy

- *Guaranteed*: provides firm (mathematically provable) bounds on end-to-end queuing delays in addition to ensuring bandwidth availability.
- Controlled Load: "better than best-effort," but cannot provide the strictly bounded service that Guaranteed service promises.

b) Differentiated Services

Differentiated services provides a simple and coarse method of classifying services of various applications and differentiates between them

- Expedited Forwarding: minimizes delay and jitter and provides the highest level of aggregate quality of service. Any traffic that exceeds the traffic profile (which is defined by local policy) is discarded.
- Assured Forwarding: Excess traffic is not delivered with as high probability as the traffic "within profile," which means it may be demoted but not necessarily dropped.

VI. QoS ROUTING

Qos routing is "a routing process that guarantees to support to a set of QoS parameters during establishing a route". The QoS routing in MANETs is needed only to support the multimedia real-time communication like video-on-demand, news-on-demand, web browsing, traveller information system etc. These applications require a QoS guarantee not only over a single hop, but also over the entire wireless multi-hop. The QoS routing supports QoS-Driven selection and QoS Reporting and provides path information at each router. The goal for QoS routing two factors:

- The QoS routing schemes can help admission control. That is, routing protocol not provides route to destination, but also computes the QoS, that is supportable on a route during the process of route computation. It accepts a new connection request, if it finds a suitable loop-free path from the source to destination having necessary resources (bandwidth) available to meet the QoS requirements of desired services, otherwise the connection request is rejected.
- QoS routing scheme that considers multiple constraints provide better load balance by allocating traffic on different paths subject to the QoS requirements of different traffics.

The problems of QoS routing

i. The distributed applications such as Internet phone and distributed games demand very diverse QoS constraints on delay, delay jitter, cost, loss ratio, bandwidth, etc. Multiple constraints often make the routing problem intractable. For example, finding a feasible path with two independent path constraints is NP-complete.

ii. The network state changes dynamically due to transient load fluctuations, connections in and out, and links going up and down. The growing network size makes it increasingly difficult to gather up-to-date state information in a dynamic environment. The performance of a QoS routing algorithm can be seriously degraded if the state information being used is outdated.

iii. Any future integrated-service network is likely to carry both QoS traffic and best-effort traffic, which makes the issue of performance optimization complicated. It is hard to determine the best operating point for both types of traffic if their distributions are independent. Although the QoS traffic will not be affected due to resource reservation, the throughput of the best-effort traffic will suffer if the overall traffic distribution is a misjudge.

iv. Today's optimal path routing algorithms do not support alternate routing. If the best existing path cannot admit a new flow, the associated traffic cannot be forwarded even if an adequate alternate path exists.

Hence it is evident that the QoS routing algorithms must be adaptive, flexible, and intelligent enough to make a fast decision.

VII. CONCLUSION

Multi-hop mobile radio network, also called mobile ad-hoc network is created by a set of mobile nodes on a shared wireless channel. This network is adaptable to the highly dynamic topology resulted from the mobility of network nodes and changing propagation conditions. Mobile ad-hoc networks must be able to provide the required quality of service for the delivery of real-time communications such as audio and video that poses a number of different technical challenges and new definitions. The development of mobile ad-hoc networks provides great chances in various areas including academic, defence, disaster recovery, industrial environments, and healthcare. Nevertheless, there are many challenges that require to be addressed as well. These challenges needs to develop efficient routing procedures, mechanisms for reducing power consumption and extending the battery life, mechanisms for efficient use of limited bandwidth and communication capacity, new algorithms for information security, and making smaller but more powerful mobile devices. In short have to improve QoS in MANETs. This paper provides basic concepts related to QoS in networking, especially in MANET. In the upcoming paper tries to represent the improve QoS in MANET by applying genetic algorithm to routing protocol.

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