Implementation of QoS for Adaptive Multimedia in Wireless/ Mobile Network

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Abstract: **One of the best known QoS specification techniques is QML (Quality Modeling Language), which has been proposed in this paper. However, QML is focused on the specification of application layer QoS properties whereas in wireless systems it is also important to explicitly deal with hardware layer properties. Therefore this work carries the hardware specifications in QML as well so that the complete wireless system can be specified. From the readings of the existing system, following QML specifications has been created for both case studies for the different mobile computing parameters.**

INTRODUCTION

QoS AND MOBILE COMPUTING

Software developers spend the majority of their time concentrating on the functional aspects of the software they produce. It is, after all, their job to make the software they produce do the things that it is supposed to. However, it is often at least as important to the user that software not only provides the functions they require - but that, in its operation, it meets certain other non-functional requirements. For instance: speed of operation may be highly important in systems which require a rapid rate of transactional throughput; availability may be important in critical systems; security may be important where private data is being exchanged. In fact, it is almost always the case that a number of such factors are relevant to any one system.

The web service and Grid service architectures provide an appealing model in which to make use of third party software or software components (exposed as services). In using these architectures the need to be able to reason about the kind of non-functional factors mentioned above is highlighted because the user or developer has no direct control over these factors themselves. In service-oriented architectures it is therefore desirable to be able to clearly state non-functional requirements, to reason about them during design, and to be able to specify, monitor and negotiate the relevant parameters once the software or system is deployed. This allows the user or developer to more easily trust services, to choose services dynamically and to assess how much to pay for them (it is therefore one key building block in the creation of a service marketplace). Research aimed at achieving this vision groups the above concepts together under the banner of Quality of Service (QoS).

A large body of existing research already exists in the field of QoS as it is perceived from a networking, telecommunications and distributed multimedia perspective. As discussed later there is some overlap, but there is also a degree of disparity between this research and QoS research in the service-centric sense. In the following section this disparity is discussed and the meaning of Quality of Service is made more explicit by examining the way in which the term has traditionally been used and how it is being extended to better suit today's service-oriented architectures. In Section 3 the potential use of QoS in service-centric systems is discussed as well as how services might be used in practice as this affects how QoS should be best applied. Section 4 discusses existing work on QoS, particularly in the area of QoS specification. The final section concludes by taking these technologies into consideration whilst discussing what is required of these and future technologies in order to achieve the service-centric QoS vision.

Application of Quality of Service in MANET

QoS refers to a level of service that is satisfactory to some user (i.e. it is not necessarily just about the 'best' level of service across the board - but about meeting user requirements). The related term Service Level Agreement (SLA) is often used to describe the agreement between the user and the service as to what constitutes 'satisfactory'. As well as QoS agreements, an SLA may also contain agreed cost, service functionality and other agreed parameters.

The term QoS, as it is most commonly used in practice, originated in the fields of networking, telecommunications and distributed multimedia. Even here the precise definition varies. However, it generally tends to refer to the request, specification, provision and negotiation of some or all of the following network characteristics:

- Bandwidth (or throughput)
- Latency (or delay)
- Jitter
- Error Rate
- Availability (or uptime)
- Network Security

These properties are often further subdivided (e.g. latency into one-way or two-way, error rate into packet loss or sequence error rate). Various metrics may also be employed to quantify these properties. For instance, jitter metrics might include the maximum difference in latency, the standard deviation of latency or some qualitative measure of the degree of variability in latency.

This concentration on network QoS appears to provide rather too narrow a definition of the term. Users are generally interested in the end-to-end QoS provided whilst using a specific service or piece of software. This means that not only does the network have an effect - but the software itself, the host system and even the user system may influence the QoS that the user will actually experience. Even in the realm of distributed multimedia this is the case (consider, for instance, the effects of using different codecs on the observed quality or of using a mobile device with limited resources for playback rather than a desktop PC).

Following the trend set in the area of service-oriented architectures, it is suggested here that the term QoS be used in a broader end-to-end sense, encompassing anything on the path from the user to the service which may affect quality. QoS may then refer to characteristics of the service host, the service implementation itself, the intervening network and the client system.

Some aspects of application or service QoS which may be of interest broadly fall into the following areas (as with network QoS, there are various metrics and sub-categories which may be applied to all of these):

- Dependability (including availability, reliability, security and safety)
- Accuracy of operation
- Speed of operation
- Failure Semantics

These characteristics are specific to the service, and hold some meaning no matter who the client is. Conversely, network performance characteristics vary depending on the route between the client and the service. Network QoS measurements taken between one client and some service can therefore not be used as a reliable indicator of what network QoS it is possible for that service to provide to some other client.

The characteristics of interest in the service host and the client system are largely the same. These broadly fall into the following categories:

- Dependability (including availability, reliability, security and safety)
- Speed
- Storage
- Operating System
- Installed Software
- Software Configuration

It may be that QoS parameters at all of the levels mentioned above need to be taken into account. For instance imagine some service operation that performs a calculation and returns the result to the client. If time to complete is of importance to the client then not only the service's speed of operation (e.g. mean time to complete) is relevant - but it may not be possible to ignore the network latency, jitter, bandwidth and error rate. To give the entire end-to-end picture the client system speed and scheduling policy may also need to be taken into account. The other reason client system characteristics may sometimes be of interest is if they occasionally affect the contract it is possible for a service to agree to. For instance the service provider may want to ensure you have a certain software configuration (e.g. a certain codec installed) before making any agreement.

The number of factors which could affect end-to-end QoS for an arbitrary service could no doubt be extended even further, and with the broadening of the scope of what a service actually is (beyond multimedia applications) it is often the case that network performance diminishes in its importance to the client compared to other factors. It is therefore worth noting here that a QoS language should be extensible in order to be applicable to new situations. It is also worth noting that in handling QoS specifications, descriptions and agreements that they may consist of any subset of the parameters mentioned here and may also involve custom parameters.

OVERVIEW OF MOBILE COMPUTING SYSTEMS

In this section, we describe some of the most significant characteristics of mobile systems, drawing mainly from [KATZ 94, IMIELINSKI 94, DAVIES 96a]. The treatment of how these characteristics affects QoS is covered in the next section, although this section focuses on those attributes of mobile systems which are most relevant to QoS and distributed systems, as described in the previous section. The areas described are:

i) The types of mobile application, mobile host and identification of two categories of mobility;
ii) The effects of changing location and the management of location information;
iii) The effects of mobility on link characteristics;
iv) The impact of portability on hardware design, and the restrictions this then places on application design.

The reader looking for a comprehensive set of references to work on mobile communications and computing may find Agrawal, Sreenan and Srivastava's bibliography and web resource pages [AGRAWAL 98] informative.

Categories of Mobility

There are many aspects to mobility, and the vital characteristics one considers important depend on the viewpoint being taken, however we suggest the following computing system oriented characterization of mobile systems based on computing device, network support for mobility and application requirements, which draws some of its underlying categorization from [DAVIES 96a].

Firstly we look at the computing devices available for use. Mobile hosts may have very limited computing, storage and user interface facilities such as palmtop computers or personal digital assistants (PDAs), and devices integrated into cars etc. They are likely to be less powerful than typical desk-top workstations, and are not capable of running network services other than to support local users. More powerful laptops (also called notebook computers), could provide a remotely accessible service, such as a database. These are in essence scaled down versions of desktop workstations, providing similar or moderately limited computing, storage and user interface characteristics.

Next, we consider two categories of mobility supported by the available communications infrastructure. Mobile systems allow full, transparent mobility during use, by means of wireless communications methods. In nomadic systems, mobility is not transparent, requiring a new connection to be explicitly established by the user after relocation of the host [KATZ 94]. They are typically based on wired dial-up, or local area network communication facilities. For example, a nomadic user may carry a lap-top and connect to a network at various times from their home, office and various remote sites such as client's offices or hotels. Whilst travelling between these locations the lap-top is disconnected from the network. The user may then make large geographical movements between connections, and connections over equipment with widely ranging capabilities, but during connection will exhibit relatively static characteristics. In contrast a mobile user may be connecting to a network using their mobile phone whilst travelling in a train.

During the course of a connection the radio reception experienced is likely to have varied widely, and the physical location of the device may be hundreds of miles from its starting point. While mobile telephony is generally implemented in terms of a series of discrete connections to base stations providing "cells" of coverage, a sophisticated system may be implemented such that discontinuous connection is abstracted or hidden from the user or application. In practice, most fully mobile communications systems, based on cellular telecommunications, are compositions of local communications systems (cells), with protocols for "hand-over" of communication between cells when mobility requires re-connection to a more appropriate cell.

It is generally the case, with current technology, that this hand-over is not seamless, but occurs within time limits expected by the target application of the network, i.e. speech for mobile telephony. This problem is discussed further below. It can also be expected that mobile systems are also nomadic i.e. their position can be expected to change whilst disconnected as well as during connection.

LITERATURE SURVEY

Chalmers, D. Sloman, M.[1] presented the specification and management of Quality of Service (QoS) is important in networks and distributed computing systems, particularly to support multimedia applications. This paper is a survey of QoS concepts and techniques for mobile distributed computing environments.

Garcia, C.[4] presented the arrival of fourth generation mobile networks, based on IP core networks, lead us to the development of certain services, such as: Quality of service, mobility and AAA. This paper proposes architecture to supply quality of service support based in the differentiated services technique.

Frolund Svend, Koistinen Jari[6] presented a general Quality of service Modeling Language (QML) for defining multi-category QoS specifications for components in distributed object systems. QML is designed to support QoS in general, encompassing QoS categories such as reliability, performance, security, and timing.

IMPLEMENTATION DETAILS

Simulation is that the execution of a system model in time that provides data a few systems being investigated. Events occur at distinct points of your time. Once the quantity of such events is finite, we tend to decision it distinct event. A distinct event machine consists of a bunch of events & a central machine object that executes these events so as. The following items are most vital or essential to any simulation:

- An abstract framework of events
- An arrangement to manage events
- Functions to come up with random variables
- Facilities to permit objects to act

In this section, we tend to gift the simulation studies for the projected formula and therefore the IEEE 802.11e waterproof protocol. Simulation is performed on Network Simulator (NS) version 2.32.

EXPERIMENTAL SCENARIO

In this section, the simulation results for the proposed algorithm and the IEEE 802.11 MAC algorithm are given. Simulation is performed using Network Simulator (NS) version 2.32. Scenarios are created by increasing the no. of nodes. A traffic generator with CBR distribution has been used to provide offered load in this simulation. For processing of intermediate results TCL & AWK scripts have been used. The generation of results requires installation of NS2 over Ubuntu or Windows operating systems.

CONGESTION CONTROL

Simulation has been performed for the congestion control scenario using NS-2 (2.32) and results are drawn.

Throughput calculations from existing and proposed mechanisms

TABLE4.1: Throughput of the network for with and without modifications in the existing algorithms

No. of Nodes	Throughput with Existing Security	Throughput with Modified Security
30	23.01	26.63
35	90.3	97.96
40	68.13	81.21
45	86.05	50.42
50	128.96	145.96
110	241.85	352.76

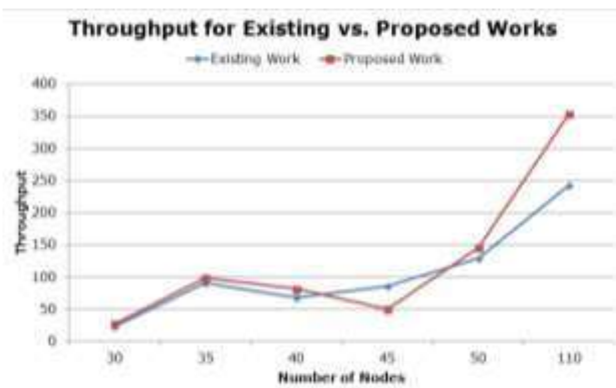


Figure 4.1: Throughput for Proposed Work vs. Existing Work

Inference: from the graph it's seen that the throughput of the proposed work is higher the existing work. For node count 45 only the graph is showing downfall of the throughput of the proposed implementation than the existing implementation which may be due to random positioning of the nodes. It is also seen that as the density of the nodes is increasing beyond 50 the growth of the throughput curve is increasing rapidly than the existing work.

Packet Delivery Ratio calculated from existing and proposed algorithms

TABLE4.2: Packet Deliver Ratio of the network for with and without modifications in the existing algorithms

No. of Nodes	Throughput with Existing Security	Throughput with Modified Security
30	95.566	95.556
35	99.3289	99.359
40	98.6486	99.0683
45	98.5748	99.648
50	99.2519	99.434
110	98.6395	99.6294

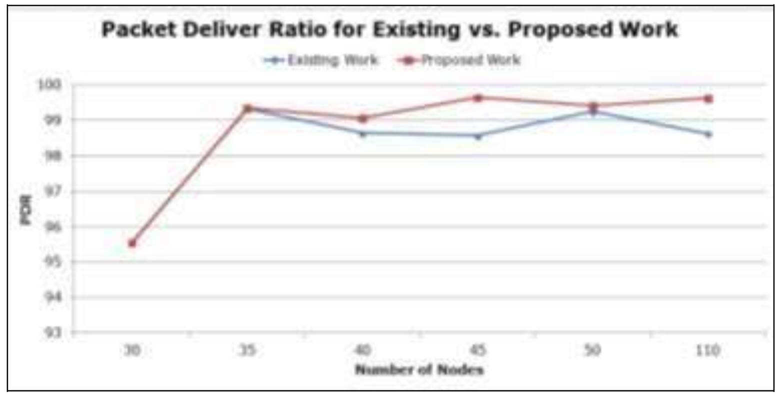


Figure 4.2: Packet Deliver Ratio for Proposed Work

Inference: from the graph it's seen that the packet delivery ratio of the proposed implementation is always higher than the existing values of the packet delivery ratio. The increase of PDR is not very much higher but still it is great for all density of the nodes. As the node density is increased the relative increase of the PDR value has also increased than the existing work.

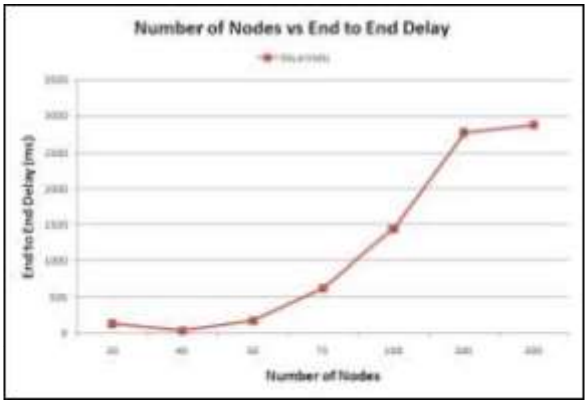
SECURITY

Simulation is being performed for the proposed work using NS-2 (2.32) and results are drawn.

End-to-End Delay Measured using Proposed Work

Table 4.3: End to End Delay Measured Using Proposed Work

NUMBER OF NODES	DELAY(MS)
20	130.32
40	34.63
50	174.13
75	627.51
100	1436.67
200	2769.49
300	2873.21

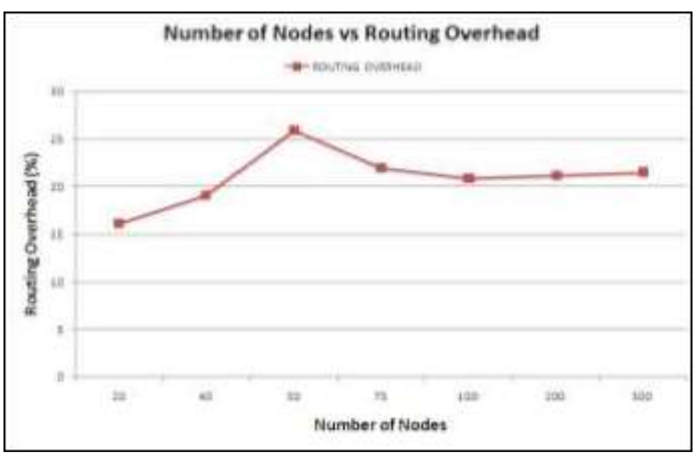


The end to end delay is an indicator of how good communication links and the proposed work is showing a gradual increase in end to end delay with the increase of the number of nodes. A sudden increase in case of 200 nodes has been seen which is occurring due to placement of the nodes. A smooth decrease for 300 nodes verifies the above reason.

Routing Overhead Measured using Proposed Work

Table 4.4: Routing Overhead Measured Using Proposed Work

NUMBER OF NODES	ROUTING OVERHEAD
20	16.09
40	19.05
50	25.94
75	21.98
100	20.85
200	21.13
300	21.51



.Fig 4.4: Routing overhead for the Proposed Work

Routing overhead is a measure for extra load being applied on the routing protocol and communication system. It is measured in % and from the readings and graphs it is found that the proposed work do not impose much routing overhead on the system. Even when the number of nodes are too many, the routing overhead is under control and do not show any abnormal growth.

Date Packet Rate Measured using Proposed Work

Table 4.5: Drop Packet Rate Measured Using Proposed Work

NUMBER OF NODES	DROP PACKET RATE
20	13.32
40	31.66
50	15.41
75	16.83
100	13.32
200	17
300	15.24

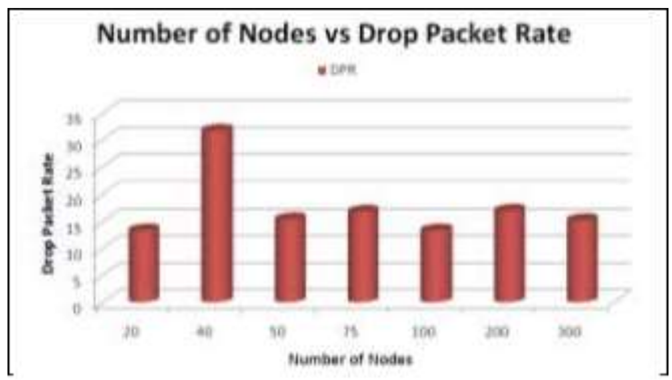


Fig 4.5: Routing overhead for the Proposed Work

Data packet rate is a measure for the amount of packets drop rate during the communication

Packet lost = Number of packet send – Number of packet received

Packet Drop Rate = Average Difference of Packets Received and sent

The lower value of the packet lost means the better performance of the protocols

Data packet rate is being applied on the routing protocol and communication system. It is measured in % and from the readings and graphs it is found that the proposed work low data packet rate on the system. Even when the number of nodes are too many, the routing overhead is under control and do not show any abnormal growth.

Comparison between the Existing Work & Proposed Work

Table 4: Drop Packet Rate Measured Using Proposed Work

NUMBER OF ATTACKERS	S-ODMRP	ODMRP-HT	PROPOSED
2	76	78	86
4	72	68	70
5	70	62	84
8	66	59	83
10	64	56	87
20	58	42	83

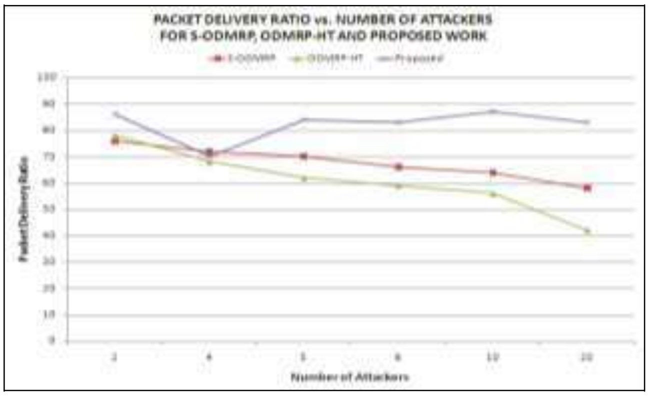


Fig 9.4: Comparison between the Proposed Work & Existing Work

From the graph it is clear that the packet delivery ratio of the proposed work is higher than the existing works in the base paper.

Advantage of use of QML in QoS

Use of QML is strict specification of the testing and controlling of the implemented system and its working thereof. In this work the QML specification provided in chapter of proposed work enlists the requirements for managing the quality of the mobile system and it has been found to be accurate and up to the mark for all specifications.

It is also found that in both the case studies the QML specification has been under the limit for all its executions. For comparison, control and quality both the existing system and modified systems have been processed to generate the results. Since existing systems are already calibrated and standard therefore these can be taken as reference for evaluation of modified systems.

From the graphs it is seen that the QML specifications provided are matched in almost all cases and such specifications done initially helps not only in improving the system implementation quality but in sustainability of the system as well.

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