UML Profile for Modeling Quality of Service - A Review

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Abstract: **In today's environment, the need, uses and applications of the mobile networks are increasing. Most of the data communications depend on these emerging technologies. Mobile computing systems have non-functional properties that differ from fixed distributed systems due to the radio and mobile terminal characteristics. The term mobile computing system is used when considering a system consists of: application, middleware, operating system (OS), mobile terminal, and mobile communication system. End-to-end quality of service (QoS) in mobile computing systems is therefore the combination of QoS characteristics and QoS mechanisms across the system.**

Introduction

In today's environment, the need, uses and applications of the mobile networks are increasing. Most of the data communications depend on these emerging technologies. Mobile computing systems have non-functional properties that differ from fixed distributed systems due to the radio and mobile terminal characteristics. The term mobile computing system is used when considering a system consists of: application, middleware, operating system (OS), mobile terminal, and mobile communication system. End-to-end quality of service (QoS) in mobile computing systems is therefore the combination of QoS characteristics and QoS mechanisms across the system [1].

Reliable message transfer with error control and notification of non-delivery is common in many modern communication systems. However, it is only recently that much thought has been given to the ability to specify timeliness, and the perceived quality of the data arriving, particularly where more complex (multi-) media are being used. The underlying concepts of bandwidth, throughput, timeliness (including jitter), reliability, perceived quality and cost are the foundations of what is known as Quality of Service (QoS).

In designing the applications over mobile networks, one must focus on quality of service (QoS). It is often required where a fixed bit rate is provided and the application are delay sensitive, and in those networks where the capacity is a limited resource, for example in mobile data communication. Quality of service 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. [1][2][3].

Gives administrators control over network resources and allows them to manage the network from a business, rather than a technical, perspective.

Ensures that time-sensitive and mission-critical applications have the resources they require, while allowing other applications access to the network. Improves user experience. Reduces costs by using existing resources efficiently, thereby delaying or reducing the need for expansion or upgrades. Modeling is a necessary activity while designing a system or application. It aims to express the essentials of some aspect of the system being designed, without unnecessary detail. It is often represented by visually by one or more diagrams [5]. QoS requirements are identified already at design-time. For modeling a system, we need adequate modeling languages. There are many modeling languages according to the area of applications. For modeling the QoS of any system, a specialized QoS Modeling Language (QML) has also been developed. Therefore, the QML can be applied to specify QoS properties like reliability and performance [6].

QOS CHARACTERISTICS

While systems are often defined in terms of their functionality, QoS defines non-functional characteristics of a system, affecting the perceived quality of the results. In multimedia this might include picture quality, or speed of response, as opposed to the fact that a picture was produced or a response to stimuli occurred. Table 1 shows the main technology-based QoS parameters which we consider, and Table 2 summarizes the main user-based parameters. [HUTCHISON 97] describes perceived quality as user level QoS requirements, and then maps them to lower level QoS characteristics. [NAHRSTEDT 95a] describes a selection of quality characterizations in terms of QoS parameters and value ranges, for various data types.
QoS is an internetworking issue that can be defined informally as something a system seeks to attain [7]. The goal of QoS is to provide guarantees on the ability of a network to deliver predictable results. Elements of network performance within the scope of QoS often include availability (uptime), bandwidth (throughput), latency (delay), and error rate.

QOS SPECIFICATION

An application's QoS requirements are conveyed in terms of high-level parameters that specify what the user requires [8]. QoS specification is

different at each system layer and is used to configure QoS mechanisms at each layer. Possible system layers are [9]:

- protocols - transport, network
- network layer
- middleware layer
- operating system - scheduling, resource management, real-time support
- distributed platforms - CPU, memory/buffers, devices
- application layer

QML

To facilitate QoS specification, a general Quality of Service Modeling Language has been introduced for defining multi-category QoS. QML is designed to support QoS in general QoS category such as reliability, performance, security, and timing [14]. QML has been developed at HP Software Technology Laboratory [15][16]. QML is similar to interface definition language that describes the functional prosperities of software component. It also allows specification at a fine-grained level for operations, operation arguments, and attributes. QML is designed for a good fit with object-oriented distribution architecture [6] [17].

Proposed Methodology

The main design consideration for QML is to support QoS specification in mobile computing system. We want QML to integrate seamlessly with existing mobile computing system. This overall goal results in the following specific design requirements for QML [6][17]:

QoS specifications should be syntactically separate from other parts of service specifications, such as interface definitions. This separation allows us to specify different QoS properties for different implementations of the same interface.

It should be possible to specify both the QoS properties that clients require and the QoS properties that services provide. Moreover, these two aspects should be specified separately so that a client-server relationship has two QoS specifications.

- There should be a way to determine whether the QoS specification for a service satisfies the QoS requirement of a client. This requirement is a consequence of the separate specification of the QoS properties that clients require and the QoS properties that services provide.
- QML should support refinement of QoS specifications.
- It should be possible to specify QoS properties at a fine-grained level.

Literature Review

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.

Frolund Svend, Koistinen Jari[9], proposed a general Quality-of-Service specification language, which we call QML. In this paper we show how QML can be used to capture QoS properties as part of designs. In addition, we extend UML, the de-facto standard object-oriented modeling language, to support the concepts of QML. Yang Xiao and C. L. Philip Chen [11], presented Adaptive multimedia is promising in wireless/mobile networks since it mitigates the fluctuation of resources caused by the mobility in wireless/mobile networks.

Samad, M. and Herman, S.H[12] presents a study of the quality of service (QoS) performance over the mobile IP in wireless network. This mobile IP models are developed using the OPNET modeler 10.0, a hierarchical software programming and it is utilised to analyze the performance of two metrics for QoS; throughput and packet data dropped during forwarding and receiving data packets operation. The results achieved are based on the comparison of two scenarios of mobile IP model in a wireless network.

Srivastava, M. and Mishra, P.P.[13] describes the necessary support required in various layers of mobile wireless networks, and advocates specific solutions based on empirical validations. This addresses the choices that need to be made in the design of a quality of service (QoS) framework for mobile and wireless networks. Miguel A. de Miguel[14] presented QoS-aware models support the description of software architectures with quality requirements are part of an initial submission of OMG RFP "UML Profile for Quality of Service and Fault Tolerance Characteristics and Mechanisms".

Sten L. Amundsen, Frank Eliassen, Jan Øyvind Aagedal[15], presents a general QoS framework with QoS specific elements for mobile middleware, which combines and extends existing QoS frameworks. Becker Steffen[16] presented the Quality of Service Modeling Language (QML), a language which can be used to describe QoS offerings or needs of specified services.QML has been developed at HP Software Laboratory.

Literature Outcome

The specification of Quality of Service (QoS) is important in networks and distributed computing systems, particularly to support multimedia applications. The advent of portable lap-top computers, palmtops and Personal Digital Assistants with integrated communication capabilities facilitates mobile computing. Quality of service plays a very important role to provide guarantees on the ability of a network to deliver predictable results. Modeling is a necessary activity while designing a system or application. QML are mostly used for modeling designing. This research will find out limitations of QML in QoS modeling specifically in mobile computing environments. And comparing the design line QoS parameters to actually measured parameters, and find out the ways of accurately model them. At last give some suggestion to improvements/ extensions in QML.

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