A Network and Device Aware QoS Approach For Cloud-Based Mobile Streaming

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Abstract— **In this paper we propose a network and device-aware Quality of Service (QoS) approach that provides multimedia data suitable for a workstation unit environment via interactive mobile streaming services, further considering the overall network environment and adjusting the interactive transmission frequency and the dynamic multimedia transcoding, to avoid the waste of bandwidth and terminal power. Considering the limited bandwidth available for mobile streaming and different device desires, this method could provide efficient self-adaptive multimedia streaming services for varying bandwidth environments.**

I. INTRODUCTION

Cloud multimedia services provide a capable, flexible, and scalable data processing method and offer a elucidation for the user demands of high quality and diversify multimedia. Generally speaking, accessing multimedia video services through networks is no longer a problem. he major video platforms, such as YouTube and Amazon, have good management styles and provide users to share multimedia videos easily with diversified services. No matter what the service is, users will always expect powerful, sound and stable functions. For multimedia videos, stability is of the greatest importance. As intelligent mobile phones and wireless networks become more and more popular, network services for users are no longer limited to the home. Multimedia information can be obtained easily using mobile devices; allowing users to enjoy everywhere network services. Considering the limited bandwidth available for mobile streaming and different device desires, this study presented a network and device-aware Quality of Service (QoS) approach that provides multimedia data suitable for a workstation unit environment via interactive mobile streaming services, further considering the overall network environment and adjusting the interactive transmission frequency and the dynamic multimedia transcoding, to avoid the waste of bandwidth and terminal power. Finally, this study realized a prototype of this architecture to validate the probability of the proposed method. According to the experiment, this method could provide efficient self-adaptive multimedia streaming services for varying bandwidth environments.

II. QUALITY OF SERVICE IN WIRELESS AND MOBILE NETWORKING

Mobile and wireless access to the Internet is becoming more and more popular due to the rapid spread of wireless access technologies with various speeds and ranges, such as IRDALANs, IEEE 802.11, Wireless ATM, GPRS, UMTS, etc. Devices used include mobile phones, PDAs, notebook computers and so on. Mobile IP [RFC2002] could become a common platform for mobile access, regardless of the underlying access technology, providing solutions to the many security, routing, and address problems.

An important issue in the Internet, and consequently in every network connected to it, is to support for multimedia applications (video, voice). The applications have specific requirements in terms of delay and bandwidth which challenge the original design goals of IP's best effort service model, and call for alternate service models and traffic management schemes that can offer the required quality of service (QoS, [NX99]). The term "QoS" in the Internet is a topic of active research. In this area, there are some different understandings to this concept because of the different viewpoints of research and application areas. Generally speaking, QoS designates a set of parameters, intended to represent measurable aspects of the subjective "user perceived quality". Criteria taken into account [E800] involve concepts such as service availability, retainability and integrity, transmission characteristics, as well as subjective estimates.

A common feature of the QoS models is the service contracts, either explicit or implicit, between the users and Internet Service Providers (ISPs) should be established. However, most of aforementioned QoS models are designed for fixed network computing environment. Due to the characteristics of mobile computing environment, the contracts based on these models can hardly be implemented and some enhancements to adapt them to be applied in the mobile computing environment are urgently needed. The QoS solution for Mobile IP should satisfy obvious requirements such as scalability, conservation of wireless bandwidth, low processing overhead on mobile terminals, providing hooks for authorization and accounting, and robustness against failures of any Mobile IPspecific QoS components in the network. While it is not possible to set quantitative targets for these desirable properties, the QoS solutions must be evaluated against these criteria, and even the development of wider band technology and application software, and much more.

III. NEW TERMINOLOGY IN MOBILE QOS SPECIFICATION

During these years, considerable research interests have been devoted in the mobile QoS field. As a result, some definitions concerning the QoS issues in the mobile Internet have appeared in the literature. To better understand the latest achievements, we outline some new but promising terms, most of which will be cited in the remainder of this paper.

1. Mobile QoS reference point: In [E800] it is stated that QoS measures are only quantifiable at a service access point. However, real time feedback and network response to QoS fluctuations would require the establishment of a point of reference of redefining and measuring the QoS for a mobile connection in terms of network performance. In fixed ATM networks, this point resides at the entrance to the ATM switch, i.e. at the ATM B-UNI. For a mobile system however, the overall QoS objective should include the air interface for to be meaningful to the end-user. We will assume this point residing at the interface of the fixed radio access system towards the mobile terminal.

2. Mobile QoS components: A connection involving at least one mobile user can be viewed as the concatenation [T97] of fixed and wireless inks. A mobile QoS (M-QoS) therefore, comprises of a. a fixed network component (F-QoS), relating to QoS objectives for the wireline (ATM) links, and b. an air-interface component (AIF-QoS), relating to QoS objectives for the wireless (radio) links. Handover (HO) associated parameters, of spatial (e.g., HO rate per cell) or temporal (HO rate per call) significance, will play a dominant role in the performance of mobile networks. It seems reasonable, that HO relates more closely to radio calculations, rather than fixed ones. Nevertheless, certain types of HO operations affect the fixed part of the network (e.g., inter-switch handover). To resolve this, we assume that all quality issues relating to the interaction of a wireless access part of the network, with its fixed counterpart in a static operation mode, can be grouped separately (in AIF-QoS) from those directly associated with HO. Therefore, we introduce an additional logical refining: a handover component (HO-QoS), relating to all quality issues directly influenced by user mobility.

3. Mobile QoS parameters: QoS objectives should include appropriate metrics. A clear distinction is made between network performance parameters that can be objectively measured and subjective QoS parameters depending on user perception. The most indicative QoS metrics are the ones mostly affected by network performance. Considering their scope, metrics could be classified as call level and transport level QoS parameters.

4. Loss profiles: Due to the high loss characteristics of the mobile networks, it will advantageous to applications if they can characterize a way in which packets should be dropped in such cases. The QoS parameter "loss profiles" [S96] gives applications an opportunity to choose between a bursty loss and distributed loss in case of an overloaded situation. An audio application may choose to have a bursty loss because the output is still tangible if a few words are dropped. A distributed loss is better for a video application because it will appear as flicker on the screen. Considerable attention has paid in the distinction of "loss profiles", most of which are known as "TCP optimization".

5. Power Level: Because, as discussed, the base station (BS) needs to be aware of the power situation in the mobile so that it can change the way data is sent to the mobile. The "power level" [SK97] parameter informs the BS about the battery power situation in the mobile and the BS changes the way it schedules packets based on the power profiles. The profile categorizes the way packets must be sent in a low power situation. While some applications would like to reduce the average rate of sending data others may choose to send some important packets as in layered video.

6. In [CK01] a new IPv6 option called "QoS Object" is introduced depending on the context, the QoS Object is included as a Destination Option or a Hop-by-Hop Option in IPv6 packets carrying Binding Update and Binding Acknowledgment messages. When included as a Hop-by-Hop Option, QoS Object triggers certain QoS procedures at the intermediate network domains. This document describes these QoS procedures for the cases of best-effort, MPLS, DiffServ and IntServ domains, which practically cover all the cases of QoS enabled network domains that would be available in near future. QoS Object is included, depending on the context, either as a Destination Option or as a Hop-by-Hop Option along with the packets carrying Binding Update and Binding Acknowledgment options. The basic idea is to include QoS Object as a Hop-by-Hop option along with the binding message that travels in the same direction (HA to MN, CN to MN or MN to CN) as that of MN's QoS-sensitive packet stream. As this packet traverses different network domains in the end-to-end path, the QoS Object is examined at these network domains to program QoS support for the MN's data packets.

7. Probability of seamless communication: Maintaining a reservation when a mobile moves between regions is a challenge because of possible blackout situations during handover. A scheme is required to define how smooth this transition should be since it affects the QoS of an application. The "probability of seamless communication" parameter [S96] defines the nature of breaks that can be allowed in the service. Based on this parameter, advance buffering at the neighboring cells must be made so that the data is available when the mobile moves into that region.

IV. CONCLUSION

A lot of research has been done toward finding solutions for the landline QoS. As wireless technology matures and wider bandwidth spectrum is allocated to mobile users, wireless data customers will demand landline-like types of data services. This paper identifies major problems, challenges and requirements in providing QoS-enable mobile applications and their corresponding candidate solutions. Some existing work is outlined as a survey, while some new ideas and proposals are presented from the research viewpoint. The mobile IP promises a wide variety of applications to a wide spectrum of potential subscribers. On the other hand, there are many competing service providers offering newer and better services. Mobile IP enable QoS will be one of the ultimate criteria for successful services.

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