

Video Quality Improvement System by using Server Switching Technology

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Abstract—In this paper, we propose the video quality improvement system (VQIS). The proposed method utilizes the server switching technology to increase QoS (Quality of Service) of the UE (User Equipment). In order to evaluate the performance, we build a testbed to prove possibility of the proposed method, and measure the video quality using VQMT (Video Quality Measurement Tool). As a result, we can demonstrate that the UE has enhanced QoS.

Keywords— Video Quality, Server Switching, Quality of Service

I. INTRODUCTION

Recently, various multimedia services are increasing with the rapid increase of mobile user and wireless network technology. Especially, VoD (Video on Demand) and IPTV have been becoming popular services as it promises to deliver multimedia contents to UEs (User Equipment) at any time and at anywhere [1].

If video requests are highly skewed in a specific multimedia server such as famous sports or popular games, the specific multimedia server should maintain heavy workload to the established session and transmitted stream, which can cause the QoS degradation of the UE [2].

To solve this problem, the various existing methods have been introduced to enhance the video quality of the UE. For examples, the hybrid transmission method proposes an Adaptive Hybrid Transmission (AHT) scheme [3] for on-demand mobile IPTV service over broadband wireless access network and, the design of Video Quality Control System (VQCS) [4] proposes a video quality control system which can control video service quality through the monitoring of end-to-end available bandwidth for video streaming service like IPTV and, the contents caching method proposes a dynamic caching algorithm to reduce not only total network cost but also improve QoS of a UE [5].

However, the methods of mentioned above do not consider following situations; video requests are highly skewed in the specific multimedia server, sudden multimedia server suspension, and so on. As a result, video quality of a UE is degraded while a UE and the jammed multimedia server are connected.

The cause of the problem is that the service is concentrated to the single server. Therefore, if the UE could be provided the same service through other servers, this problem can be solve by changing the server when QoS degradation is occurred in

the UE.

That is, the enhanced QoS can be served to the UE by using server switching technology. The server switching mechanism means that the UE changes the connection between the UE and the server from congested server to available server.

Therefore, we propose a video quality improvement system (VQIS) in preparation for the congested multimedia server by using server switching technology in the multimedia servers.

In order to evaluate the performance, we build a testbed to prove possibility of the proposed method, and measure the video quality using VQMT (Video Quality Measurement Tool). As a result, we demonstrate that the UE has enhanced QoS.

This paper is organized as follows. In section 2 introduces the VQIS of proposed method. In section 3 shows the experimental result and analysis are presented. Finally, we conclude this paper in section 4.

II. RELATED WORK

In this section, we briefly review the existing QoS improvement technology such as AHT(Adaptive Hybrid Transmission), VQCS(Video Quality Control System), CC(Contents Caching).

The AHT scheme proposes an adaptive hybrid transmission technology for on-demand mobile IPTV service over broadband wireless access network. In this paper, proposed algorithm utilizes hybrid mechanism which combines multi-channel multicasting and unicast scheme to enhance not only service blocking probability but also reduce overall bandwidth consumption of the wireless system. Also, this scheme can utilize for increasing the QoS of a UE when the service suspension or service degradation are occurred [3].

However, this scheme does not consider the problems such as server overloaded, server down, server suspension, etc.

The VQCS scheme proposes the video quality control system which can control video service quality through the monitoring of end-to-end available bandwidth for video streaming service like IPTV. Since various multimedia services such as video, voice and gaming service can be provided by IPTV, and these services require large amounts of bandwidth. At this time, video quality degradation like video jerkiness, block distortion and blurring is caused when network available bandwidth is insufficient. So, this paper

periodically calculates the amount of the packets in link and measure available bandwidth by using total length field in IP header at terminal and transports video streaming with adaptive data rate to prevent video quality deterioration. Therefore, the service can be provided from multimedia server to UE continuously [4].

However, this method is also does not consider the problems when the multimedia server is not working properly.

The contents caching method utilizes to reduce not only total network cost but also improve QoS of a UE [5]. For example, the [6] proposed the dynamic caching mechanism for reducing the total network cost by considering content hit-ratio on hierarchical architecture. In proposed mechanism, the high-layer server distributes the some of the content in database to low-layer server according to content hit-ratio of the high-layer server. Accordingly, the content can be searched in low-layer server via minimum signalling and the content is effectively distributed among servers. Therefore, the UE is provided the quality service from caching server instead of the root server.

However, this paper only describes the theoretical matters but the actual implementation did not presented.

Therefore, the server switching technology and content caching methods are need to solve the problems such as QoS degradation of UE, service suspension, etc. due to multimedia server overloaded. In addition, the actual implementation is required to prove theoretical content.

III. PROPOSED METHOD

In this section, we describe the VQIS (Video Quality Improvement System) by using server switching mechanism. First of all, we present the integrated network architecture for improving QoS to the UE. After that, we describe the proposed VQIS functional architecture and procedure of server switching mechanism from UE to MS.

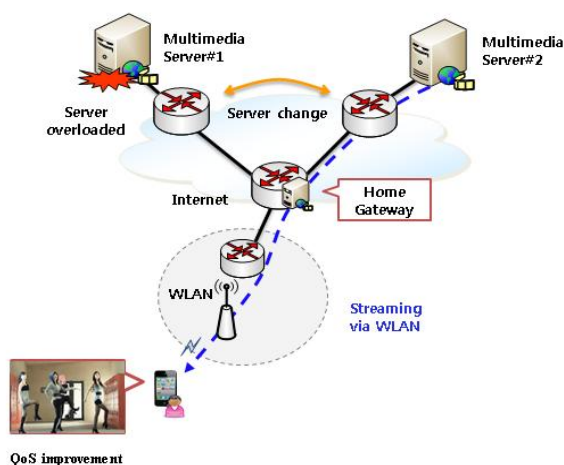


Figure 1. The integrated network for server switching mechanism

Fig.1 shows the integrated network for server switching mechanism to provide QoS to the UE. In fig.1, the integrated network is composed three devices as multimedia servers,

home gateway server(switching server), UE. The multimedia servers provides the video streaming service to UE. The HG manages the information between MS and UE such as connection information, UserID, RFID, TerminalID, Timestamp, Available Server List, etc. The UE requests the contents to the MS.

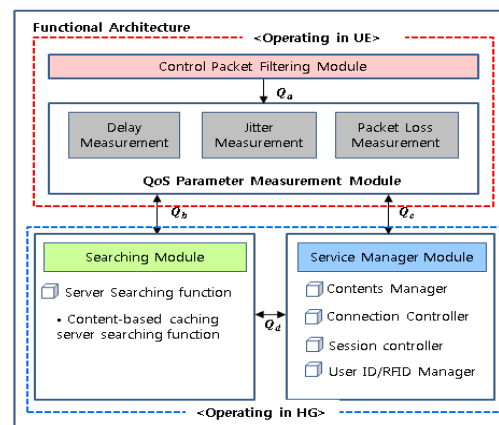


Figure 2. The proposed VQIS functional architecture.

Fig.2 presents the functional architecture to improve video quality for supporting the proposed method in the VQIS. The proposed functional architecture is configured of three modules and four interfaces.

In Fig.2, the CPM (Control Packet Filtering Module) can derive QoS parameters from the collected information of RTCP packets and, the QoS PMM (Parameters Measurement Module) deduces QoS parameters such service delay, jitter, and packet loss from the QoS PMM [4]. These modules operate on the UE. SM (Searching Module) retrieves available multimedia servers for UE with request/response MSG. SMM (Service Manager Module) manages information such as provided contents type of UE, link information between UE and available servers list, and User ID/RFID/Terminal ID [7].

TABLE 1. THE SUMMARY OF FUNCTION FOR EACH DEVICE

Name	MS#1 & MS#2	HG	UE
Function	· UserID · ContentID · Time stamp	· UserID · ContentID · Session · MS list · Switching	· Service request

Table I presents that each device key role. The MS#1 and the MS#2 manages the information such as User ID/Content ID/Time stamp. The User ID is used to know where the connection of UE is established. The Content ID is used to find content type. The time stamp uses for providing continuity service when the server switching is occurred.

The HG manages the User ID/Content ID/Session information/Available MS list. The Session information

means the connection status between MS and UE. The Available MS list presents the destination IP address of MS. The HG transmits signalling packet to the MS to response destination IP address of MS. Also, the HG performs the server switching control to improve QoS of UE due to the specific server overloaded. The UE requests the service to the MS through HG with User ID/Content ID.

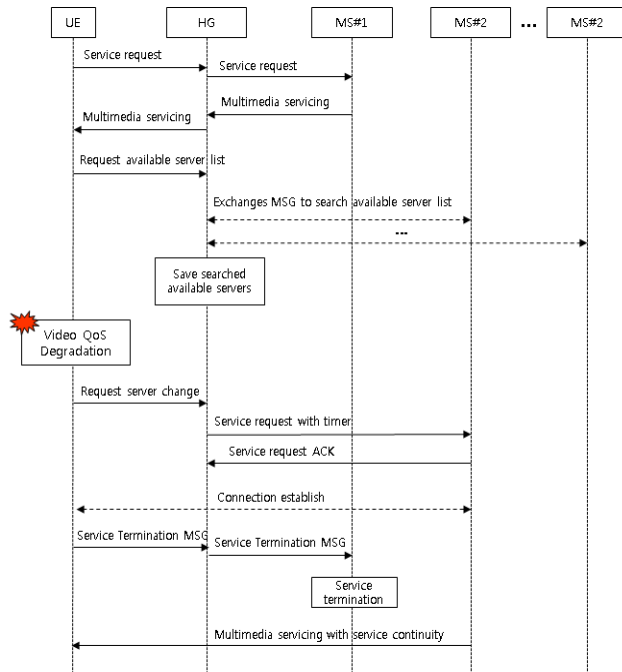


Figure 3. The procedure of server switching from UE to MS

Fig.3 shows the example of the service scenarios. First of all, the UE transmits the service request message to the HG, and the HG sends the service request message to the MS#1. And then, the MS#1 provides multimedia service to the UE through HG. Next, the UE transmits the request available server list message to the HG. The HG exchanges message to search available server list among MS#N. If the HG succeeds to find available server list, this information is saved to the database in HG. At this time, if the video QoS degradation is occurred in the UE due to server overloaded, the UE transmits the server change message to the HG. And then, the HG send the service request message with timer to searched MS#N. Timer value is used to view content continuously. If the connection is established between UE and MS#N, the UE sends the service termination message to the MS#1. Finally, the searched MS#N provides the requested contents to the UE with service continuity.

IV. EXPERIMENT AND RESULT ANALYSIS

We test the proposed method to prove possibility of the proposed method through the experiment testbed, and measure the video quality using VQMT.

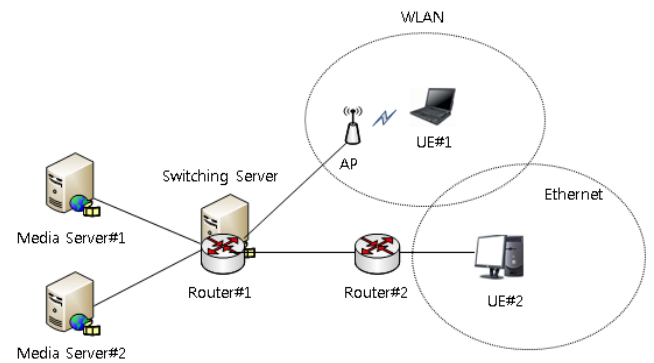


Figure 4. The experiment testbed for VQMT.

Fig.4 presents the actual implementation testbed for proposed method. We use two multimedia servers to show the server switching mechanism because there is no need to construct a large number of multimedia servers. The UEs were used the desktop PC and notebook (dual-interface) for testing the wired(Ethernet)/wireless environment(WiFi).

Also we use linux network emulator commands to the specific server(Ethernet port) such as packet loss, delay, jitter to degrade video quality of the UE [4].

```
#tc qdisc add dev eth0 root netem delay 100ms
#tc qdisc change dev eth0 root netem delay 100ms 10ms
#tc qdisc change dev eth0 root netem loss 0.1%
#tc qdisc add dev eth0 root handle 10: cbq bandwidth 5Mbit
a vpkt 1000
```

The above commands generate a delay of 100ms, 10ms jitter within 100ms delay, packet loss rate 0.1% to eth0 of multimedia server. Therefore, we can regard these commands such as the QoS degradation due to the server overloaded.



Figure 5. Video frame sample in UE

Fig.5 shows the video frame samples in the UE. The left image show the degradation of QoS in UE because the MS#1 condition is overloaded. On the other hand, the right image shows the video quality with no degradation of QoS in UE. Since the UE performs the server switching mechanism from MS#1 to MS#2 to improve QoS of UE. In contrast, if the overloaded is generated in MS#2, the UE can change the server from MS#2 to MS#1.

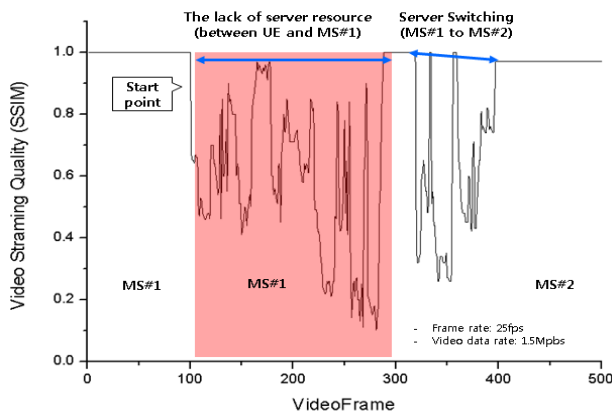


Figure 6. The analysed experiment result using MSU tool.

Fig.6 show the analyzed experiment result which is derived from the VQMT (Video Quality Measurement Tool) [8]. From the Fig.6, the UE can be adaptively changing server from congested MS#1 to available MS#2. Thus, it is clear that the UE can be improved video quality by using the proposed VQIS method.

V. CONCLUSIONS

In this paper, we propose the video quality improvement system (VQIS) which is operated in multimedia servers. In proposed method, if the QoS degradation is occurred in UE, VQIS provides the server switching function to improve QoS of the UE. For performance analysis, we construct the testbed, and measure the video quality using VQMT. As a result, we verify that the proposed method can provide guaranteed video quality in the UE.

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