

The Performance Analysis of SVC image Service for Mobile IPTV System

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Abstract—Recently mobile IPTV service becomes primary service to boost sluggish IT industry. SVC service seems to be prominent to satisfy the QoS/QoE in broadcasting service. Especially in multi-screen service, there are many different type of terminal. Therefore contents operator will apply SVC coding scheme to provide appropriate quality of image to users according to multi-terminal type. In order to provide SVC image in wireless access network, it's necessary to enhance the capacity of wireless access network, meanwhile, operators can maximize the efficiency of radio resources usage ensuring QoS/QoE to users. In this paper SVC transmission methods are suggested to increase the quality of service, and the performance analysis of suggested technologies are described.

Keywords— Mobile IPTV, SVC, Mobile WiMax, WiBro

I. INTRODUCTION

Mobile IPTV is promising multimedia service to increase the revenue of communication industry. SVC(Scalable Video Coding) service seems to be prominent to satisfy the QoS/QoE in broadcasting service. Especially in multi-screen service, there are many different type of terminal. Therefore contents operator will apply SVC coding scheme to provide appropriate quality of image to users according to multi-terminal type. In order to provide SVC image in wireless access network, it's necessary to enhance the capacity of wireless access network, meanwhile, operators can maximize the efficiency of radio resources usage ensuring QoS/QoE to users.

To provide mobile IPTV service 3GPP and WiMAX announced MBS(Multicast Broadcast Service) specification. Also currently 3GPP/LTE and IEEE 802.16m has been developed the enhanced MBS standard such as e-MBMS and E-MBS. Therefore it's necessary to provide SVC image service efficiently in MBS environment. In this paper SVC transmission methods are suggested to increase the quality of service, and the performance analysis of suggested technologies will be described.

II. MOBILE IPTV SYSTEM

Wireless access network consists of MS(Mobile Station), BS(Base Station) and ASN GW(Access Service Network Gate Way), MBS(Multicast and Broadcast Service) server, CP(Contents Provider) to provide multimedia service in mobile environment.

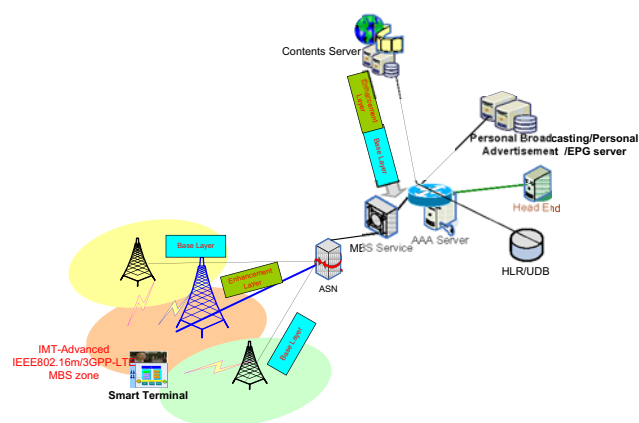


Figure 1. Mobile IPTV Service network.

To provide mobile IPTV service, MBS zone was introduced in wireless network, where several BSs were grouped to mitigate interference from other cells. In this MBS zone, same contents are delivered from several BSs simultaneously by MBS server which allocates the radio resource of BSs. Since the MCS (Modulation Coding Scheme) level will be determined according to the worst conditioned MS in MBS region, it's necessary to increase the signal quality of image data by applying dynamic power control or RS (Relay Station). Also new packet scheduling algorithm based on the characteristic of image data should be developed. In this paper, SVC delivery

scenarios and the evaluation results about suggest methods are described.

III. SVC IMAGE TRANSMISSION

SVC enables the encoding of a high-quality video bit stream that contains one or more subset bit streams that can themselves be decoded with a complexity and reconstruction quality similar to that achieved using the existing H.264/MPEG-4 AVC design with the same quantity of data as in the subset bit stream. The subset bit stream is derived by dropping packets from the larger bit stream. To provide high quality of image encoded based on SVC, it's required to provide higher transmission rate in wireless access network. Since radio resource is limited in wireless network and there are various terminal type, it's useful for BS to transmit base layer data and enhancement layer data separately. In this section two delivery scenarios are suggested to support the QoS of SVC image service.

A. SVC image delivery scenario 1

In order to provide SVC image in mobile IPTV system, the centre cell broadcasts enhancement layer image with higher power than other neighbour cells in MBS zone, that is 2 times than average power, while the centre cell broadcasts base layer image with same power level as other neighbour cells. It's to mitigate interference to other MBS zone area by boosting the power of centre cell only. The other cells broadcasts base layer image and enhancement layer image with same power level as in Fig. 2.

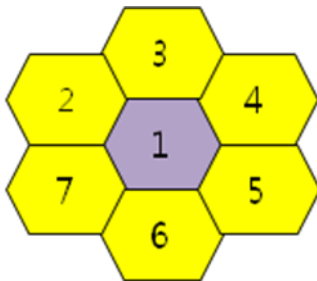


Figure 2. SVC image transmission scenario 1

B. SVC image delivery scenario 2

RS was introduced to enhance cell coverage area and throughput in IEEE 802.16j. There are two kind of RS frame structure. One is transparent frame structure which can enhance the cell throughput by cooperative relaying. The other is non-transparent frame structure which can easily extend cell coverage by multi hop management.

In this scenario, 2 transparent RS(Relay Station) are installed in every sector cell to enhance the quality of image as in Fig. 3. An enhancement layer image is simultaneously transmitted on transparent zone of MR-BS and RS to

enhance signal quality, while base layer image is delivered on access zone of MR-RS as in Fig.3 and Fig.4.

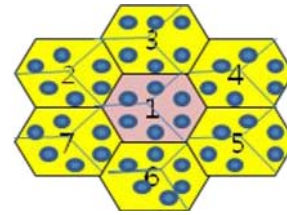


Figure 3. SVC image transmission scenario 2

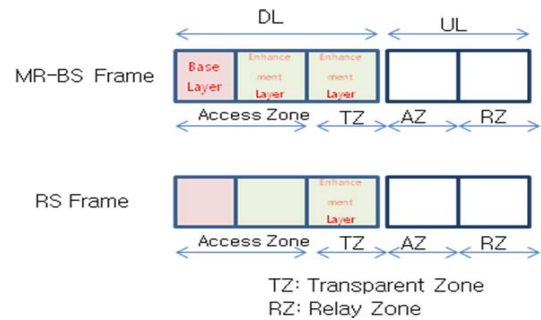


Figure 4. SVC image transmission scenario 2

IV. PERFORMANCE EVALUATION

In this chapter, suggested SVC image transmission methods will be analysed by simulation based on IEEE 802.16m standard.

A. Simulation environment

To evaluate the performance of SVC image transmission technology, 7 cell MBS zone based on IEEE 802.16m was considered.

The simulation parameter is described in Table 1.

Table 1. Simulation parameter.

Parameters	value
Center Frequency	2.5 Ghz
Inter Site Distance(ISD)	1.5 km
number of users / sector	15
Path loss type	Urban Macro
Shadow fading	-8dB, 50m
Channel Model	ITU Ped B 3km/h(60%), ITU Veh A 30m/h(30%), Veh A 120km/h(10%)
Antenna Structure	1x1(SISO)
E-MBS data size	5 Sub-band (20 LRU)
# of E-MBS data channel	2
MCS Level	QPSK 1/2
Link Adaptation	EESM
Sub-channelization	SLRU

B. Simulation results

[Scenario 1]

The simulation results of SVC image transmission technology are described.

Fig. 5 illustrates the SINR in cell coverage when base layer and enhancement layer image are transmitted with same power level in MBS zone, while Fig.6 represents SINR when enhancement layer image is transmitted with 2 times higher power level than base layer image in centre cell. In this case the other cells transmit base layer and enhancement layer image with same power level.

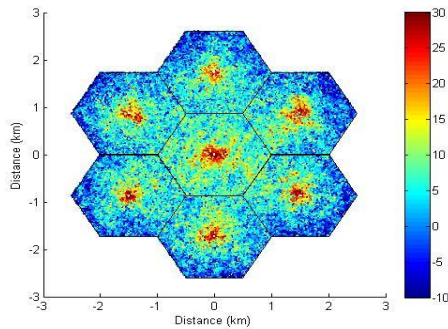


Figure 5. The performance of SVC transmission with constant power

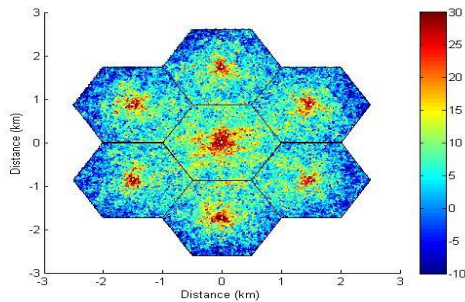


Figure 6. The performance of SVC transmission with higher power for enhancement layer

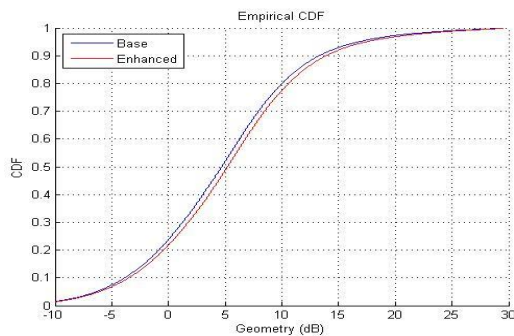


Figure 7. The CDF of SVC transmission with higher power for enhancement layer

Fig. 7 illustrates the CDF of SVC transmission with higher power for enhancement layer than base layer. According to simulation result, the transmission quality of enhancement layer is higher than base layer image. But the difference is not great because the higher transmission power level of centre cell increases the interference to other MBS zone.

[Scenario 2]

Fig. 8 illustrates the SINR in cell coverage when 2 RS are installed in every sector cell. When RS relays enhancement layer image on transparent zone with MR-BS(Multi hop Relay), the performance of enhancement layer was increased.

When the performance of base layer compared with enhancement layer image, the transmission quality of enhancement layer is higher than base layer image in Fig.9.

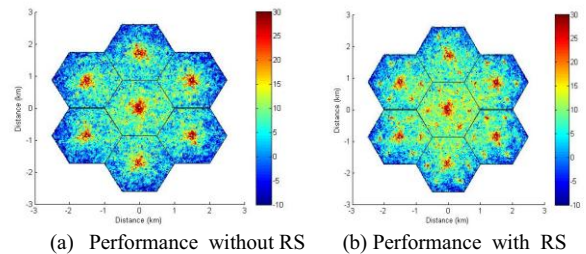


Figure 8. The performance of transparent Relay Station

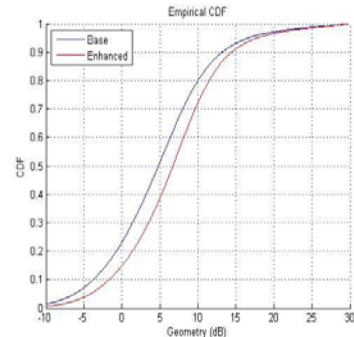


Figure 9. The CDF of SVC transmission with transparent Relay Station

Fig. 10 illustrates the success rate of SVC image and Fig.11 represents the service area of SVC with RS.

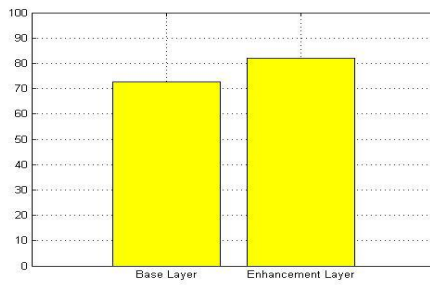


Figure 10. The success rate of SVC image

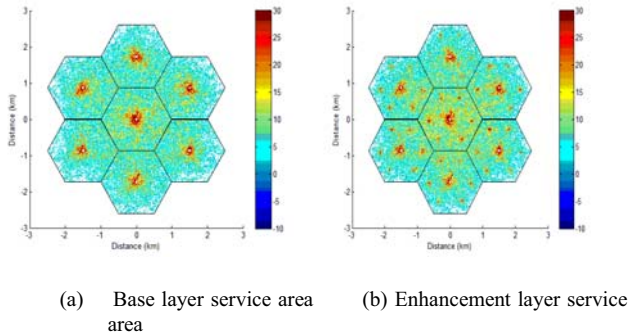


Figure 11. The service coverage area of SVC image

V. CONCLUSIONS

In this paper, we suggested two methods for SVC image transmission in mobile IPTV environment and evaluate the performance of suggested methods in terms of QoS parameter. One method is to control the transmission power level of enhancement layer. The other method is to use transparent RS. According to simulation result RS is more useful to increase transmission rate in wireless access network compared with power control method.

According to the simulation result, it's possible to provide high quality of SVC image with RS. Base layer image can be delivered with higher code rate on access zone because base layer data is smaller than enhancement layer data.

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