3DTV Broadcasting and Distribution systems

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Aim

- To develop a 3D TV broadcasting and distribution system which is compatible with the existing systems and codecs of 2D TV broadcast and distribution system

Introduction

- 3D TV Broadcasting and Distribution s/m that deliver a pair of stereoscopic images to mobile/home users.

- Based on *DMB* and *DVB-H*.

- Backward compatibility.

- 3D TV display console.

History Of TV Broadcast

- 1928-First Television Broadcast
- 1941-first Colour TV Broadcast
- 1963-NTSC and PAL standards were introduced
- 1990-HD TV concept introduced
- 2010-Trial 3D TV broadcast

Stereoscopy

- Giving slightly different images to each eye and there by producing 3D illusion in brain.

- First invented by Sir Charles Wheatstone

- 3D viewers are of two types
    1)*Active*-shutter s/m
    2)*Passive*-polarization, interference, colour anaglyph

- Auto stereoscopic system

3DTV Based on DVB-T

- Based on *video* plus *depth map* representation
- Video coding is done by MPEG-2; depth map sequence is coded independently and Txd sidewise.
- Reconstruction by *depth based* image rendering.
- Provides *backward compatibility* to existing system.
- Efficient compression
- Easy adaptation to different 3D display s/m.

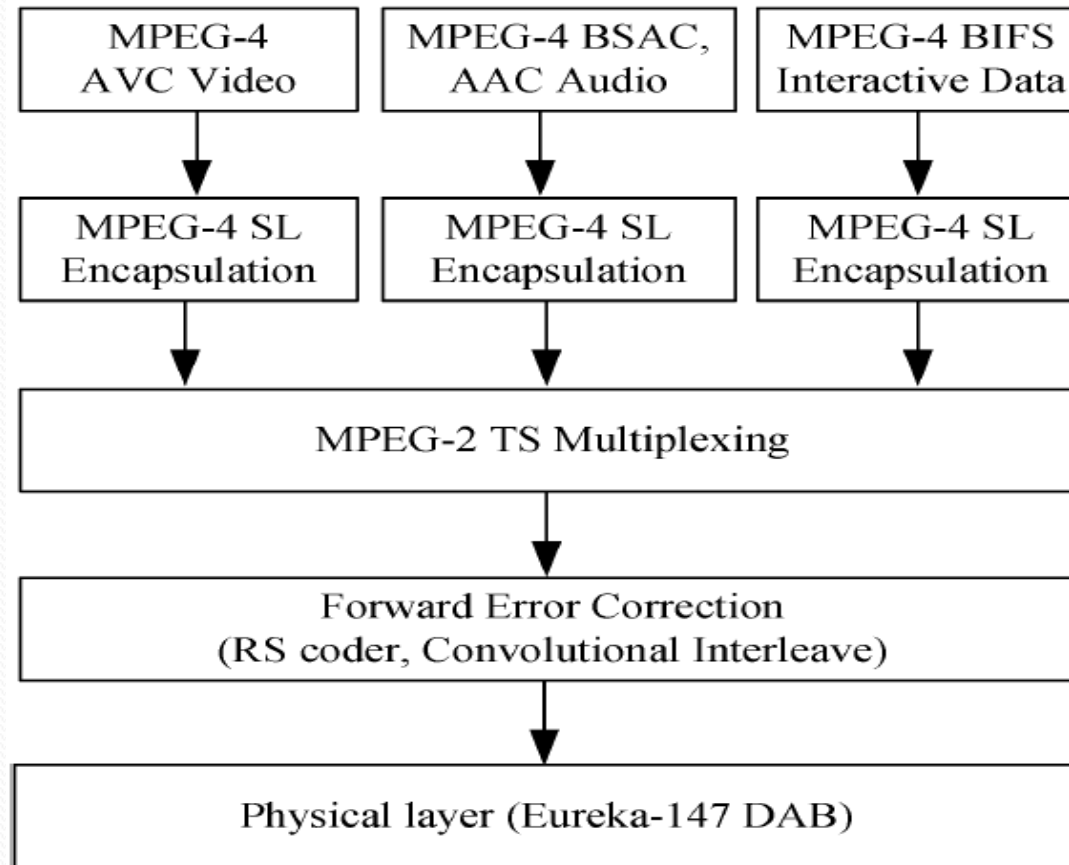# Proposed system

Mobile 3DTV

3D DMB   DVB-H

- **3D DMB**

- 3D DMB designed on T-DMB to deliver stereoscopic video/data content

- There are *three major issues* in this system development
i) *Backward compatibility*.
ii) Limitation/reduction in Txn subject to *channel bandwidth.*
iii) Effective viewing angle of auto stereoscopic display.
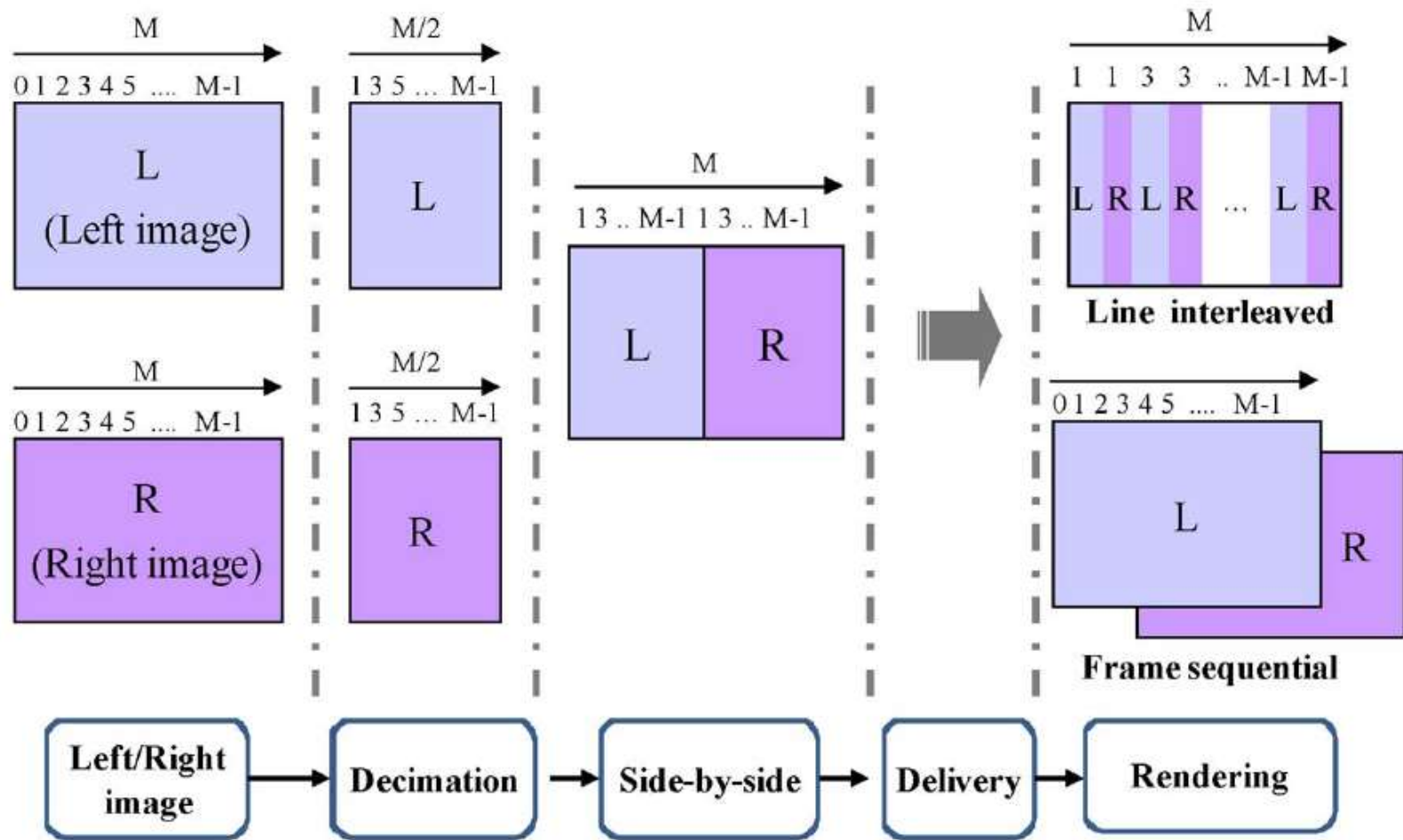
Basic protocol stack of T-DMB

- DVB requires additional AV service
 - MPEG 4-AAC
  - MPEG 4-AVC
- Interactive data service by using MPEG 4 BIFS
- AV and interactive data is synced by using MPEG 4-SL encapsulator.
- MPEG 4 multiplexed into MPEG 2 TS
- FEC is done by RS/ convolution interleave coder.

Frame compatible delivery for 3D DMB

Broadcast is done using existing codecs and infrastructure.

Left and right images are inserted alternatively so as to provide backward compatibility.

Independent coding for DMB increases *capacity by 200%*

Interview prediction save bit rate by *35%*

Residual down sampling method
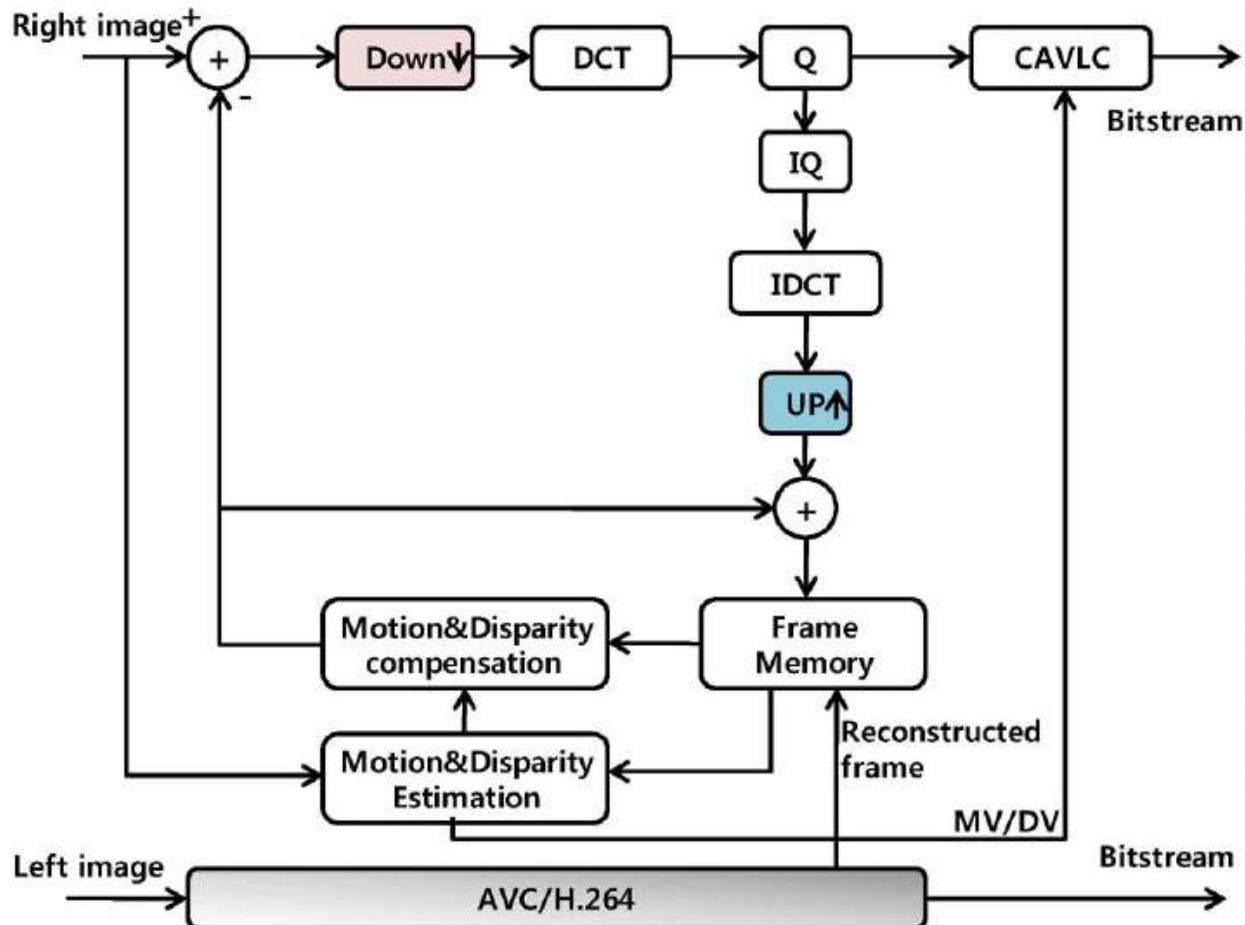
This scheme is used to improve the capacity of the s/m

 The *gain* increased from *0.2db to 2.2 db* when compared to *scalability based* coding and *independent coding*.

 3D DBM uses both *residual down sample* coding and *independent* coding.
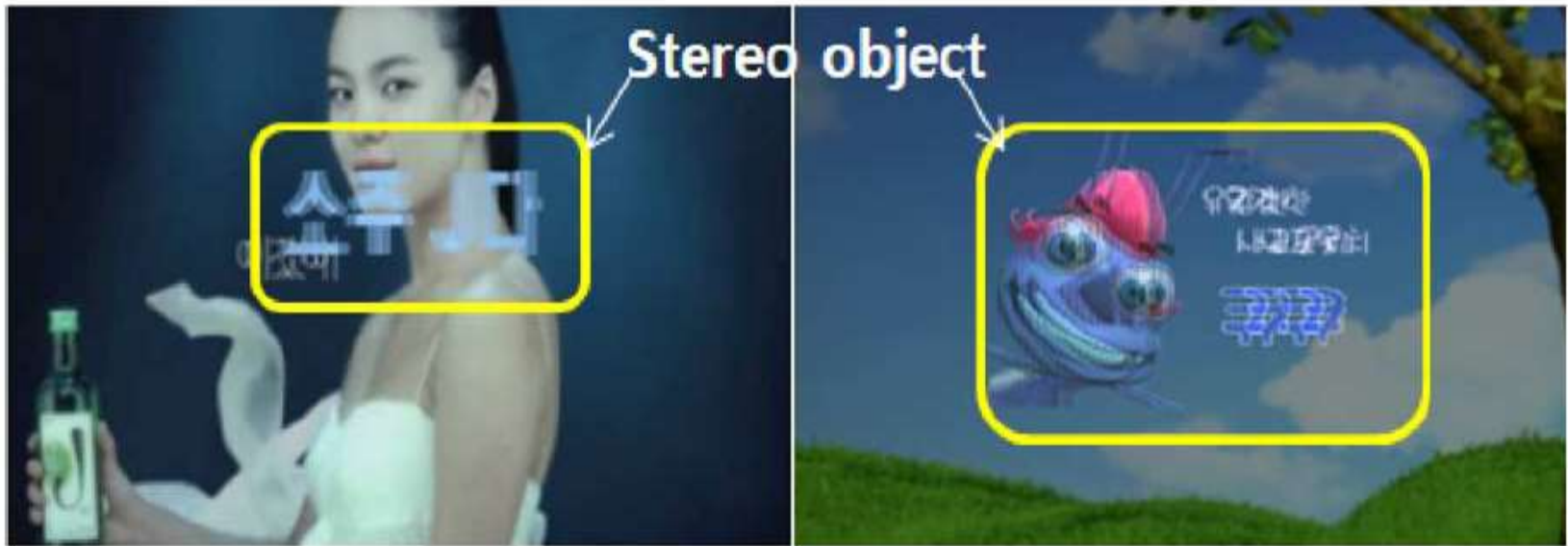
Rendering 3D objects partially on 2D video

JPEG/PNG images of *32/64kbps*

Improve capacity

Dual elementary stream for single object provide backward compatibility.

System configuration of 3D DMB

Related issues of DMB

☐ 1)backward compatibility

☐ 2)transmission overhead reduction

☐ 3)extension of effective viewing angle of auto stereoscopic display

Mobile 3DTV over DVB-H

☐ DVB-H is an extension of DVB-T

☐ Designed for *mobile* and *vehicular* reception

☐ In addition to *DVB-T channel tools* at link and physical layer *three new tools* have to be added
1)*Link layer FEC* for error protection
2)*time slicing* for reduction of receiver power
3)*intermediate 4k modulation* mode for improve
     flexibility in network planning

DVB-H protocol stack
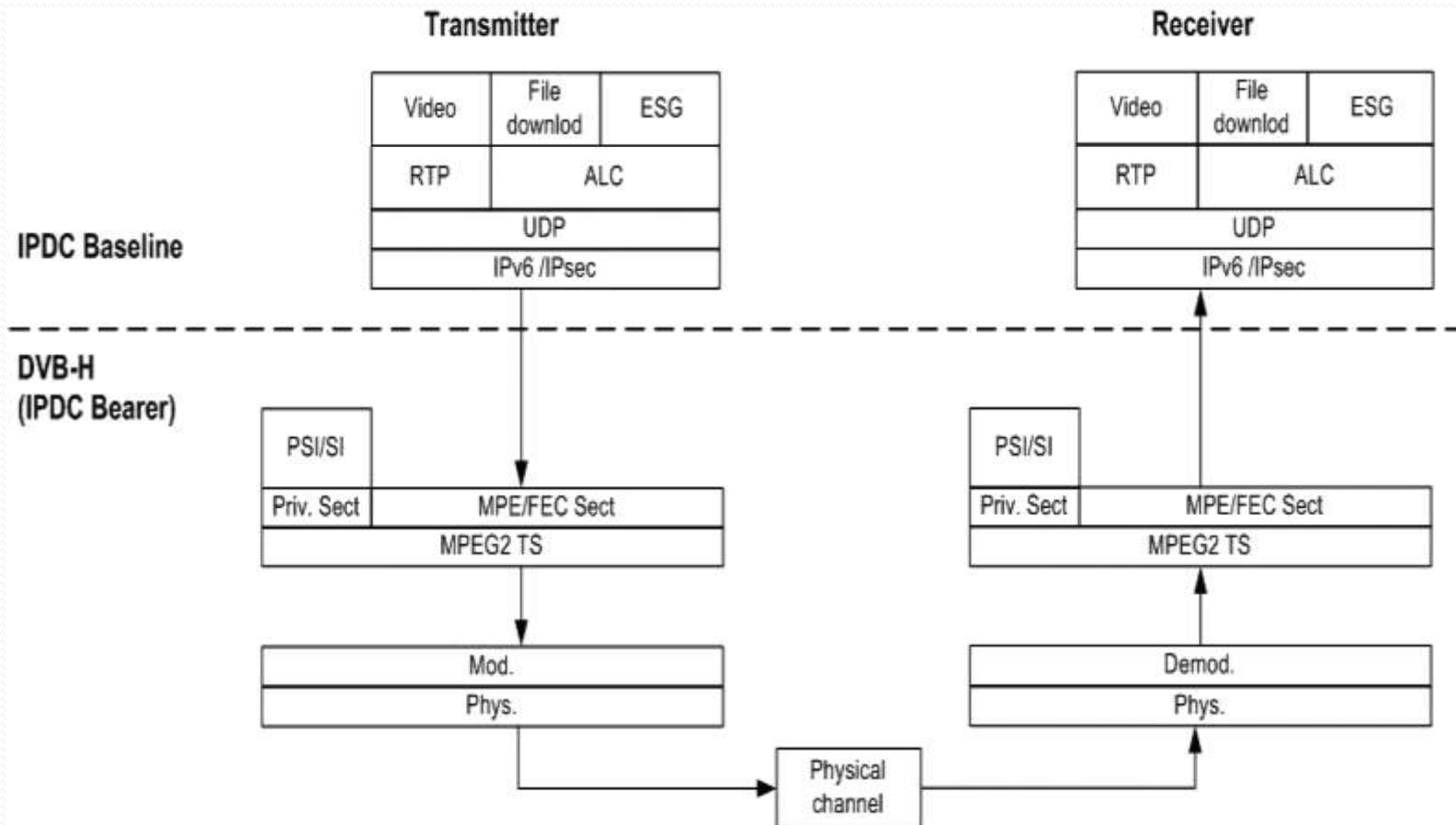
- DVB-H supports video Txn through RTP and file download and ESG through ALC
- PSI/SI are added during IP encapsulation stage along with MPE followed by MPE FEC frames
- Both MPE and MPE FEC frames are Txd in MPEG 2 TS
- Digital modulation is applied for reduction in band width
- Physical layer for connecting to physical channel

Broadcast system of 3D DVB-H
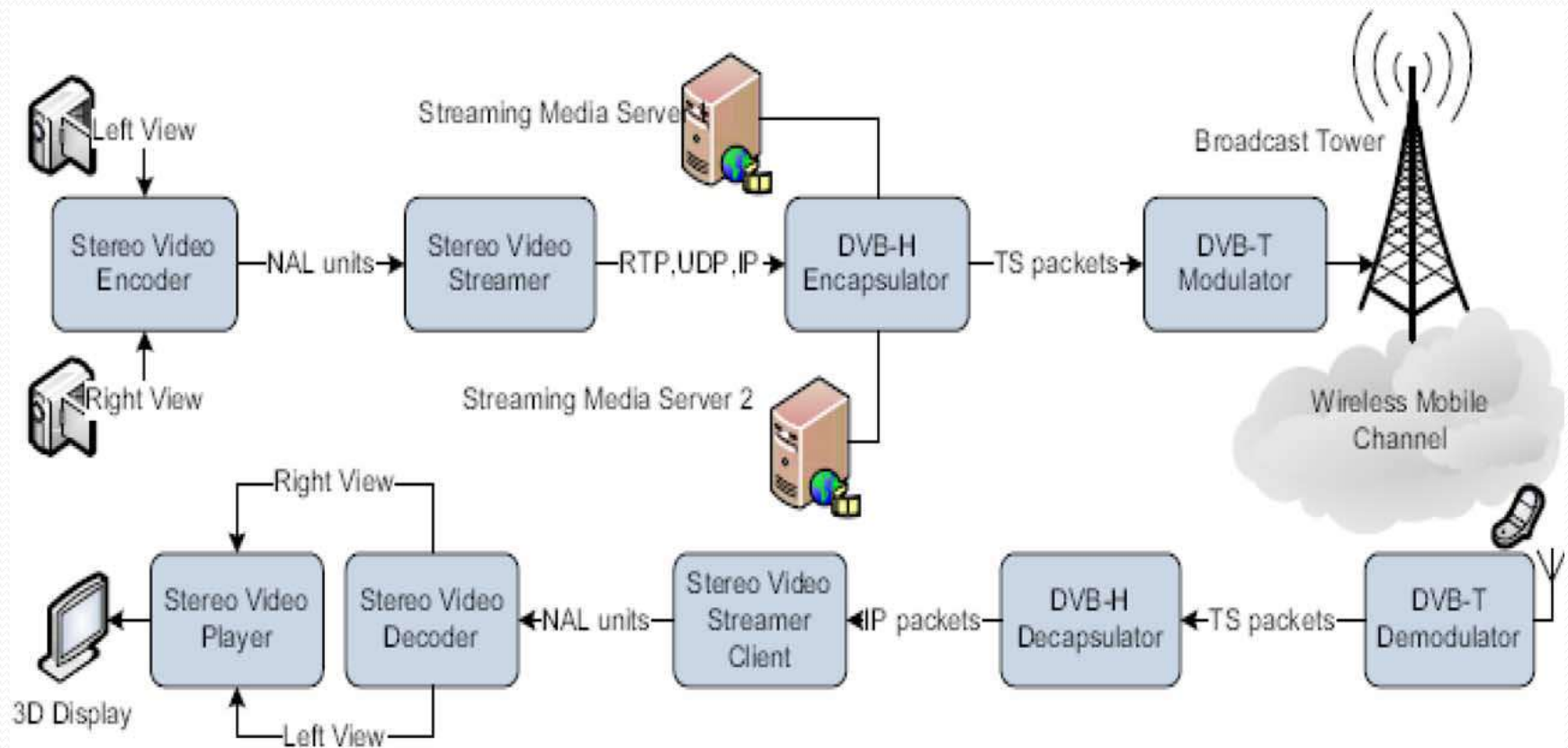
- Two images from left and right camera views are coded in stereo video encoder.
- Left and right images are compressed separately for backward compatibility.
- Streamer encapsulate the compressed videos separately to RTP,UDP and IP
- DVB-H encapsulator creates MPE and MPE FEC streams
- Compressed stereo pairs are assigned with different PID s and encapsulate in different steams
- Reduction in power consumption
- Txn signals are generated by DVB-T modulator

Auto stereoscopic display

☐ Method of displaying stereoscopic images without the use of glasses

☐ Viewing angle extension is done by using parallax barrier or lenticular lenses on LCD
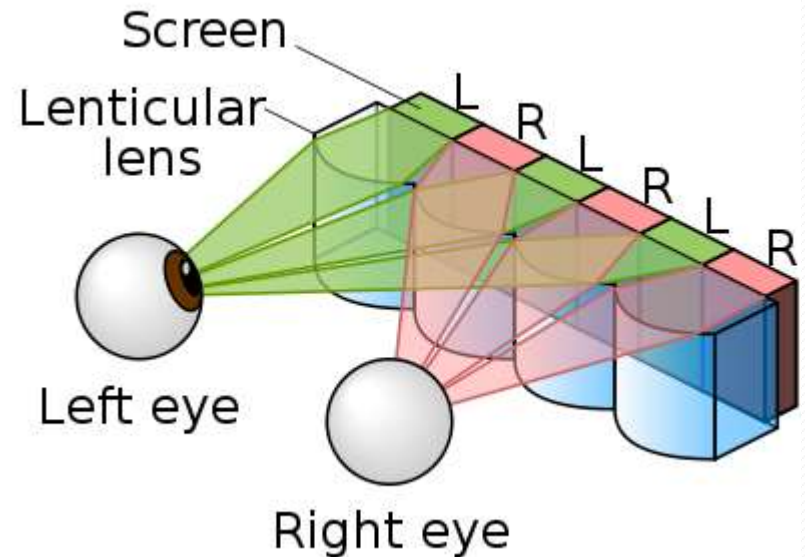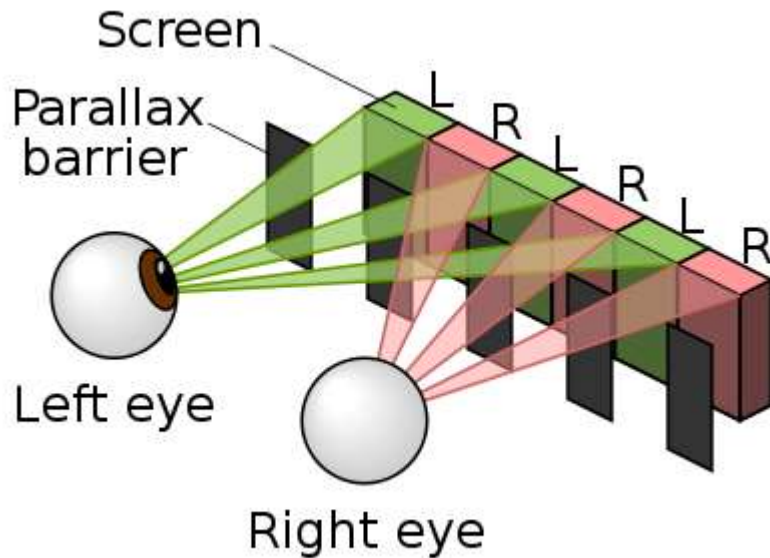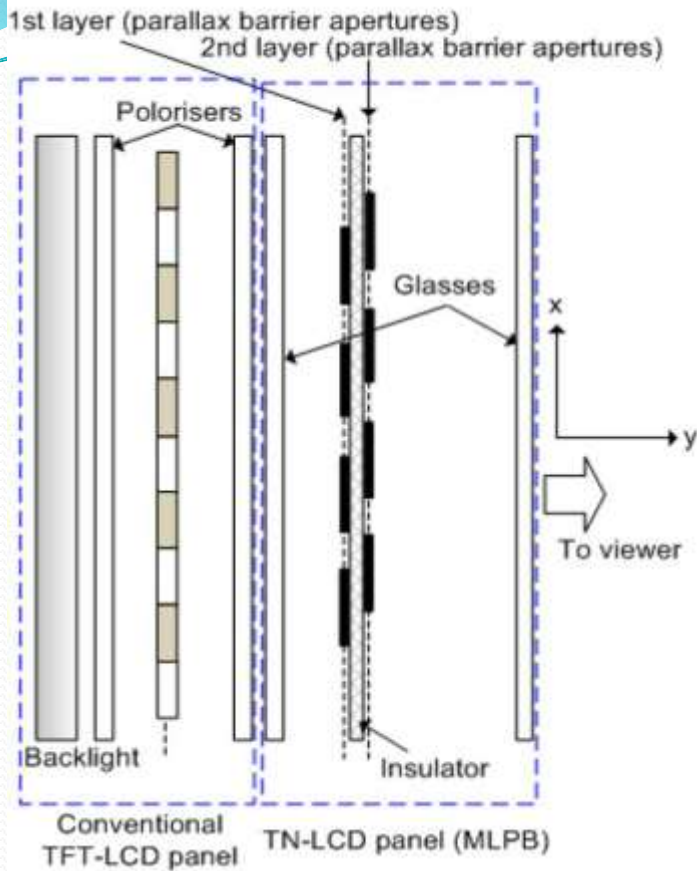
☐ MLPB based on eye tracking allow a viewing degree of freedom by stacking multiple parallax barrier on LCD

☐ It can provide 3D viewing while moving the eye

# High definition terrestrial 3DTV
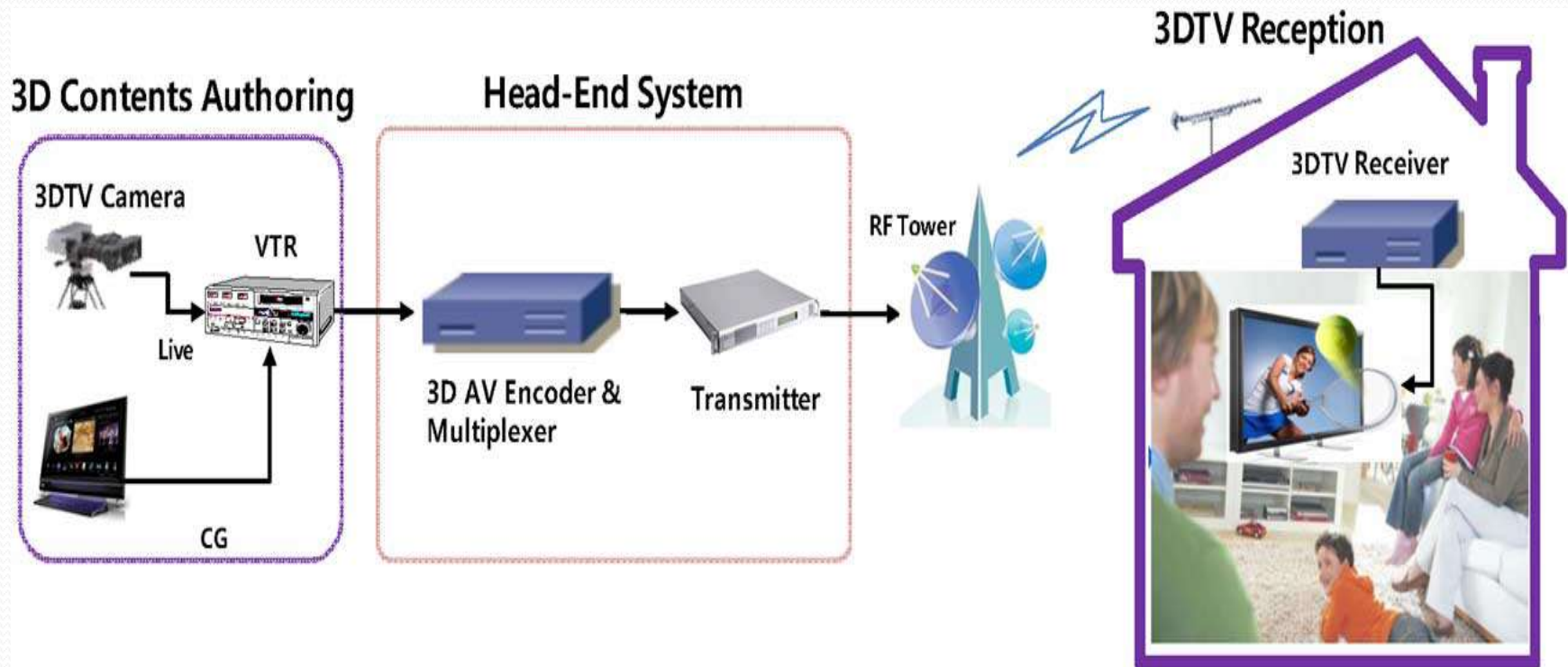
Terrestrial HD 3DTV broadcasting s/m

- 3D content created by capturing left and right images or by computer graphics.

- Left and right image along with sound is given to head end system.

- Main function of head end system is encoding multiplexing and modulation.

- Multiplexing is done after encoding with sound and images; and it combines data stream with additional control stream.

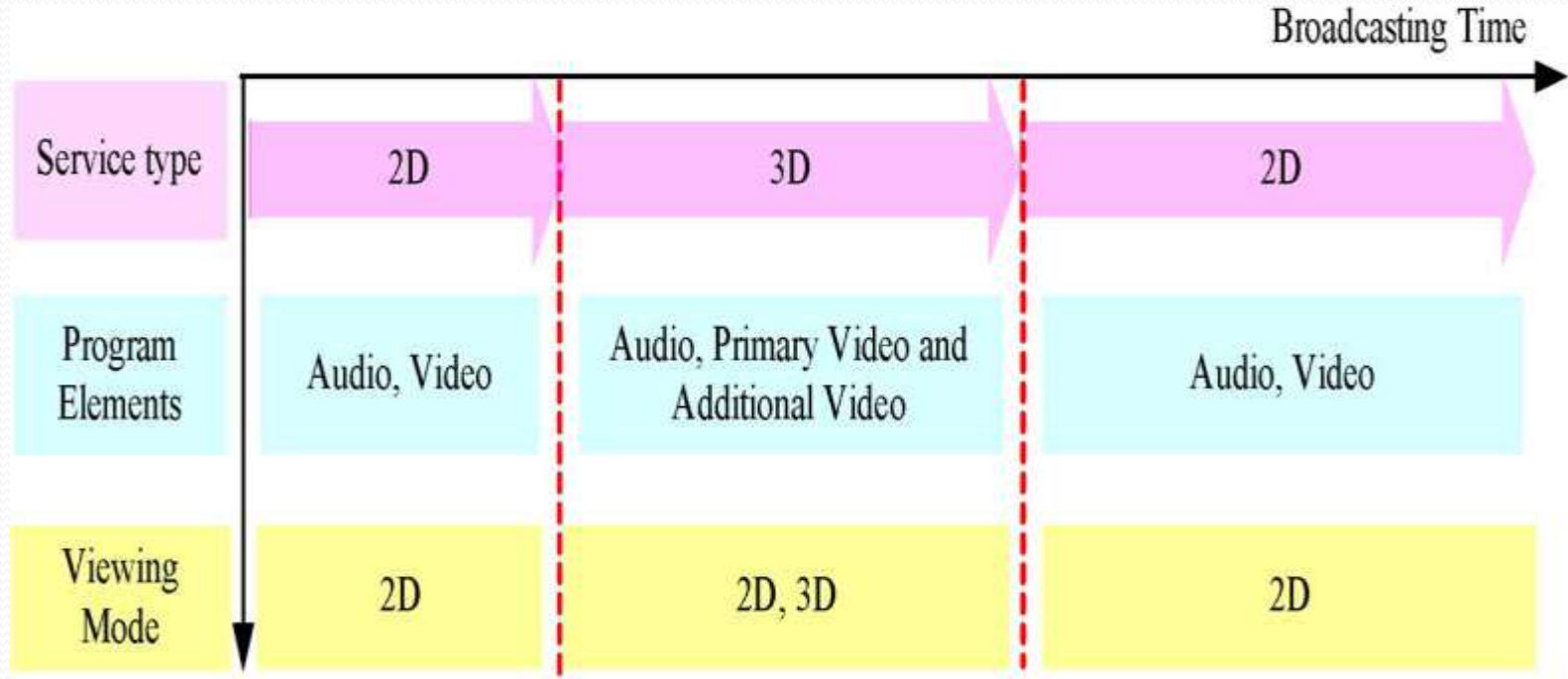- Transmitter provide error correction and modulation and transmits after modulation.

Service and requirements

☐ For backward compatibility the channel bandwidth and bit rate should be limited to 6MHz and 19.4Mbps

☐ HD image quality should be maintained at 1920x1080p at 2D and 3D viewing

19.39 Mbps

17.5 Mbps

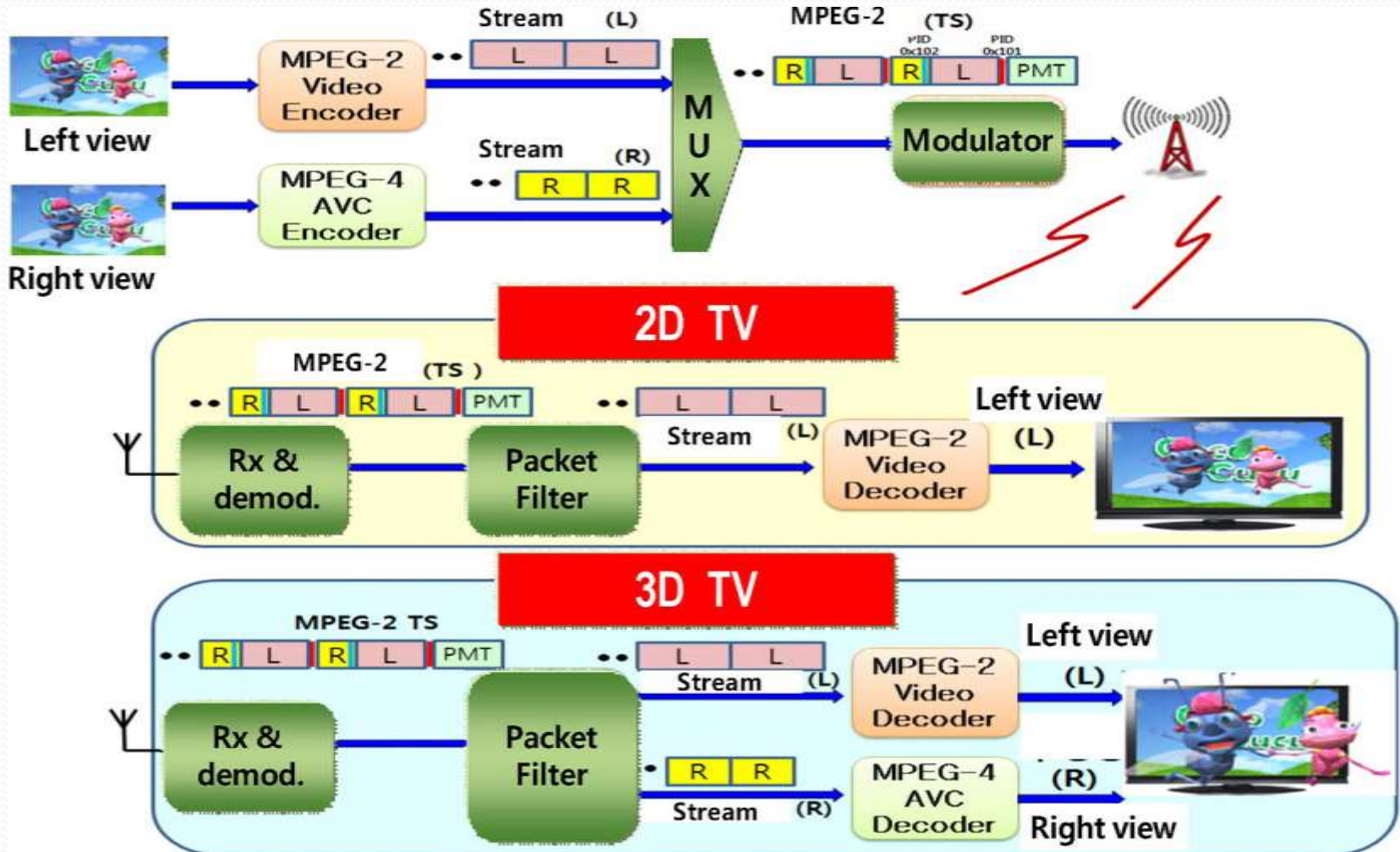L   R   Audio, data

MPEG - 2 (1080i)   H.264 (1080i)
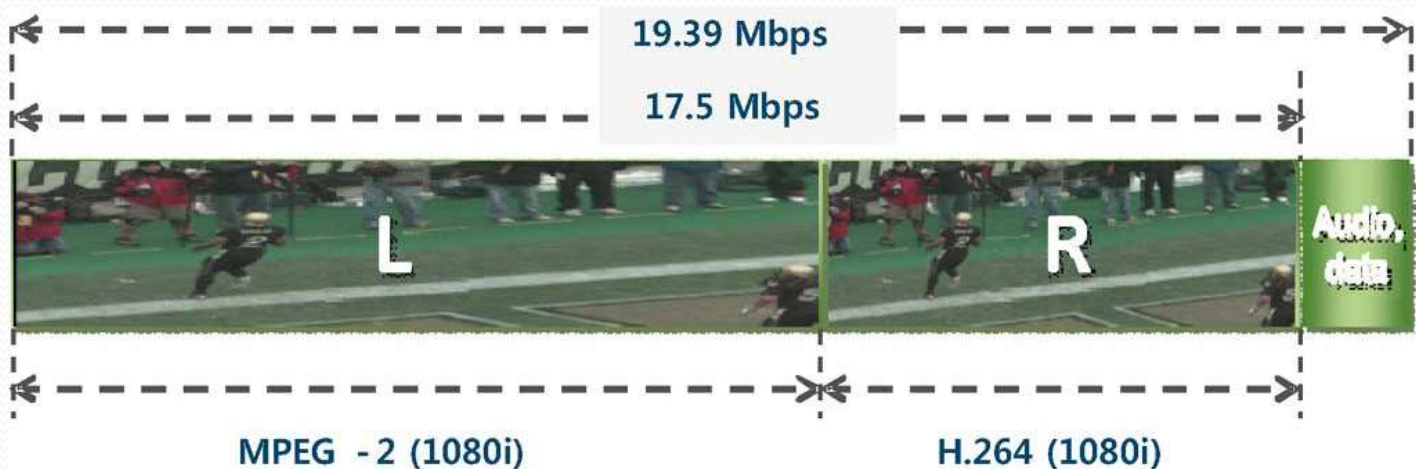
- In 19.39Mbps 17.5Mbps used for video
- In 3D the 17.5Mbps divided into two equal part
- It is difficult to multiplex two HD image in 17.5Mbps
- So we use H.264 coding in addition to MPEG 2(H.263)
- Left image with MPEG 2-backward compatibility
- Right image with H.264-reduced bit rate

Video broadcasting is of two type
1) Dedicated 3D service
2) 2D/3d mixed service

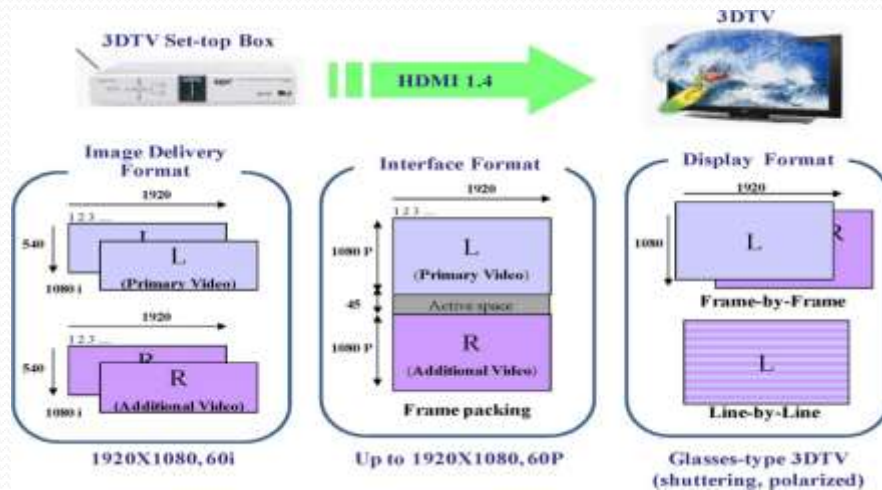|			Broadcasting Time →
Service type	2D	3D	2D
Program Elements	Audio, Video	Audio, Primary Video and Additional Video	Audio, Video
Viewing Mode	2D	2D, 3D	2D

Dual stream method of 3D delivery

Related issues

 Optimal division of bandwidth for two images

 Multiplexing and encoding streams of different codecs

 3D TV needs 60fps for left and right images , but HDMI supports only 30fps

Conclusion

- In this paper we took a look at the new technologies in the 3D TV broadcasting and transmitting.

- In the case of mobile 3DTVs, two types of new systems based on *DMB and DVB-H*, respectively have been introduced.

- In addition to this, *fixed and HD broadcast* are done with 3D broadcast

- As a result we found that HD 3D TV can be implemented with existing technologies.

Thank you..

Reference

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- [*Digital Multimedia Broadcasting (DMB) Video-Associated Stereoscopic Data Service Video Service, (TTAK.KO-07.0064, '08. 12.).*

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Questions?