# 3D-TV WEBINAR

## 3D-TV PRODUCTION

## AND FUTURE GENERATIONS OF 3D SYSTEMS

YVONNE THOMAS, EBU TECHNICAL - PROJECT ENGINEER

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# What is going on in the EBU?

- 1 EBU 3D-TV study group
- 2 European projects :

  MUSCADE *(http://www.muscade.eu)*

  3D VIVANT *(http://www.3dvivant.eu)*

  → 3D Workflow from Production - Displaying
- 3D Workshop on 6th & 7th october 2011 in Geneva, EBU

  « S3D technology and the human factors»

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# EBU 3D-TV study group

- Chairman: Andy Quested (BBC)
- Platform for exchange of experience
- Will publish a Production Guideline and a Broadcast glossary

*http://tech.ebu.ch/groups/ecv_sg_3dtv*

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# Recommendations for 3D

- High level Do`s and Dont`s
- Principial of 3D stereo camera set-up, positioning, riggs
- Camera work techniques
- Storytelling
- Postprocessing, Captioning/graphics, subtitling
- Contribution/Distribution
- Archiving
- Cost issues and budgeting

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# MUSCADE

The MUSCADE project covers the whole 3DTV chain:

- scalable and generic 3DTV representation format, advanced multi-view video coding algorithms

  → MVD4 format defined

- intelligent audio-visual capture and production assistance system performing multi-view configuration and providing calibration and metadata

  → 4-camera rig and a multi-camera version of the STAN (stereoscopic analyzer ) developed and tested

- complete multi-view scalable 3DTV chain to assess end-to-end performance over wireline, wireless and satellite networks.

  → 3DTV system without network links

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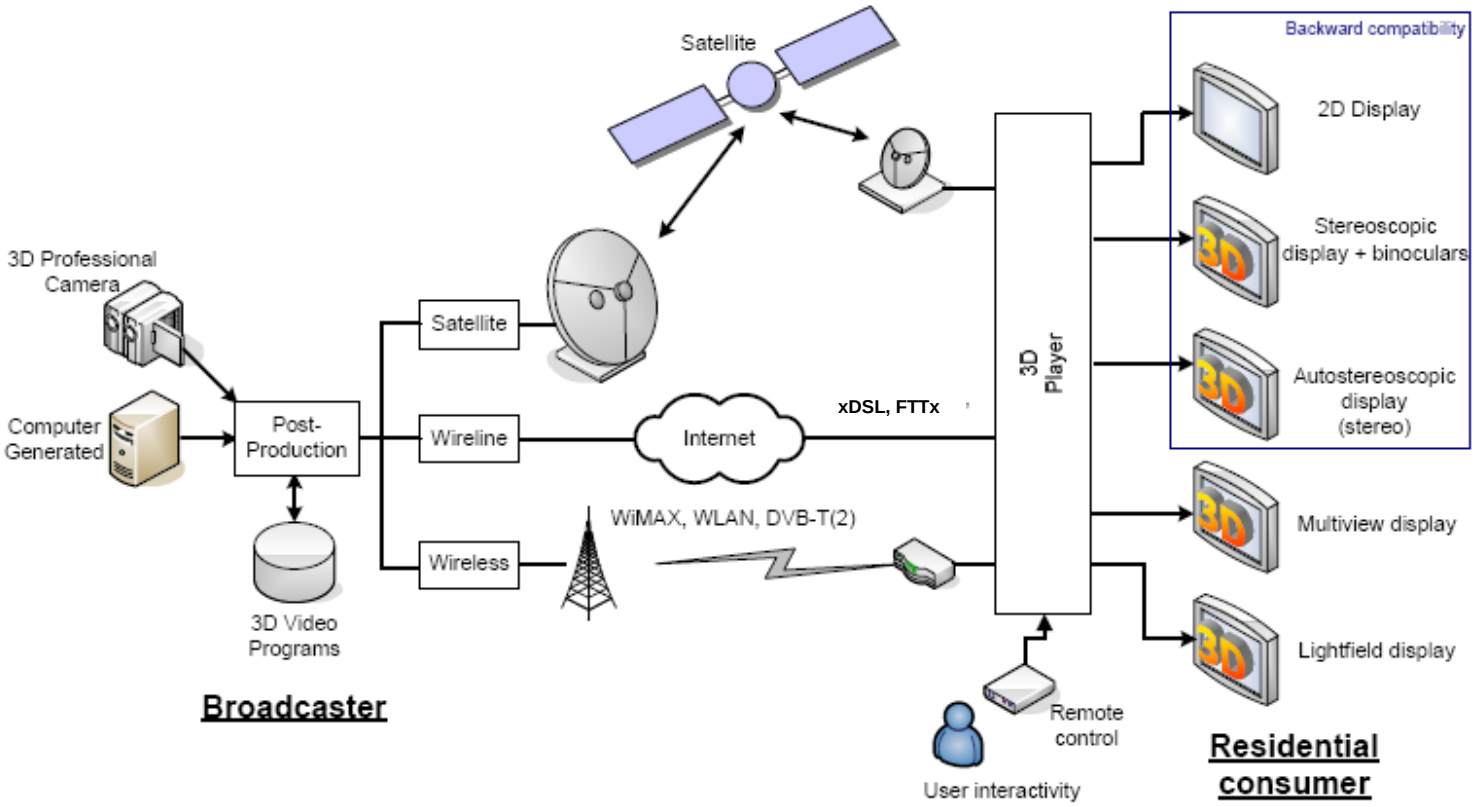
# Future 3DTV chain

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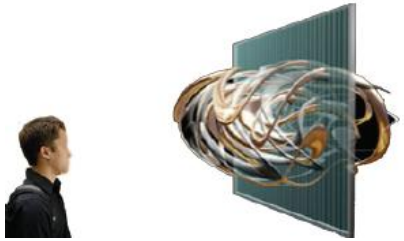
# 3D VIVANT



- To develop a demonstration of an end-to-end 3D broadcast system which offers fatigue free full parallax 3D viewing, independent of the viewer's position
- 3D Holoscopic imaging technology = single HD camera with lenticular lens array + Holoscopic display with holographic geometrical principles
- To develop an algorithm for computing the depth of the 3D Holoscopic scenes
- To provide a scalable 3D Holoscopic video codec based on existing open source codecs, such as H.264/AVC
- Multimodal story-telling

  → An offline 3D holoscopic computer animation has been created

- To develop techniques for the generation and playback of 3D spatial sound to add to the immersive experience

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# 3D Vivant system

- 3D Holoscopic imaging technology =

  single HD camera with lenticular lens array

  + Holoscopic display with holographic geometrical principles

3D holoscopic image of a horseman featuring horizontal parallax with a 600 µm lenticular pitch

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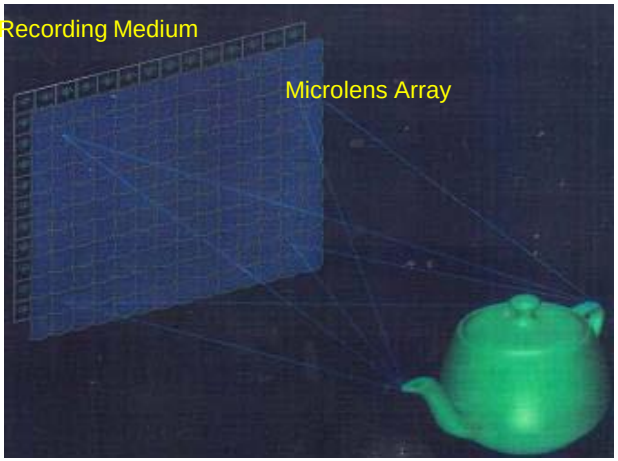
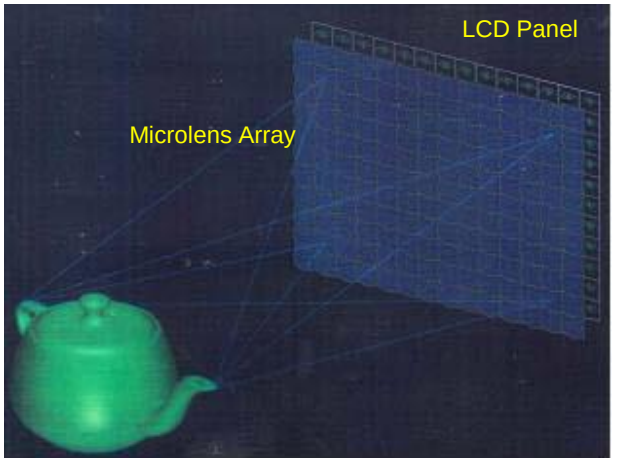
# 3D Holoscopic Displays




Camera – Array - Display

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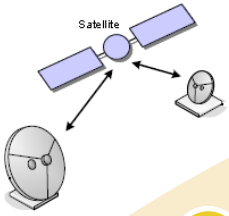
# 3D Workflow




S3D

Displaying

Receiving

Distribution

Post-Prod.

Production

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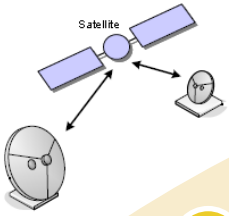
# 3D Workflow - Production

S3D

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# 3D Workflow - Production

- Differences of 2D and 3D production:

- Second camera
- Storytelling → depth script « monocular depth cues will help you »
- Questions before production 3D:
  - How do we process 3D?
  - What are the traps while producing S3D?
  - What are the medical aspects?
  - What is my depth budget?
  - For which screen size do I produce it?
  - Which format do I use?
  - .... and many more

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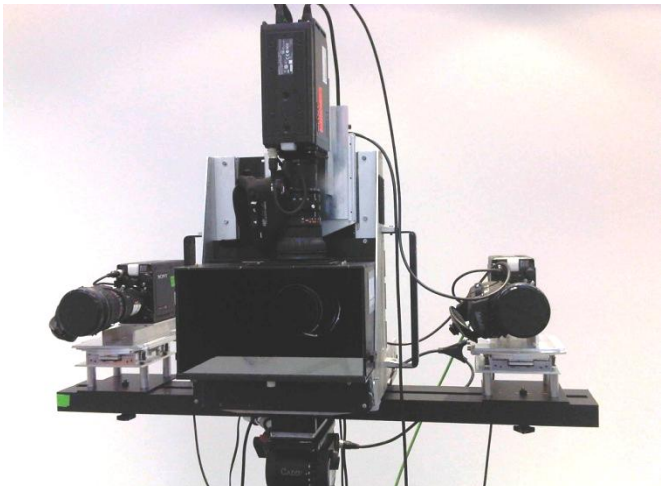
# 3D Workflow - Production

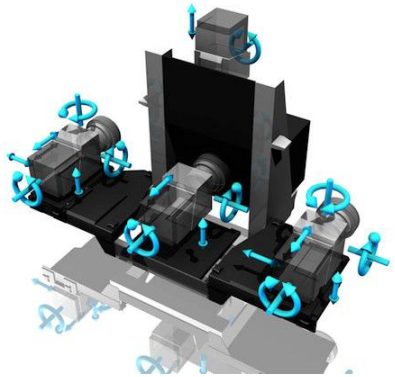
SbS - Stereo-Rig

(http://3dnewsandreviews.com/uploads/3D%20camera%20rig%20Redrover.jpg)

Beamsplitter - Stereo-Rig

(http://www.fdtimes.com/news/wp-content/uploads/2010/03/3DFR_HDW750_diagonal_c300_1080m.jpg)





Multicamera - Rig

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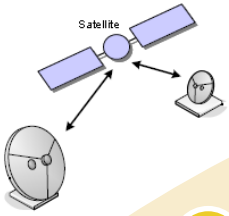
# 3D Workflow – Post-Production

S3D




Displaying

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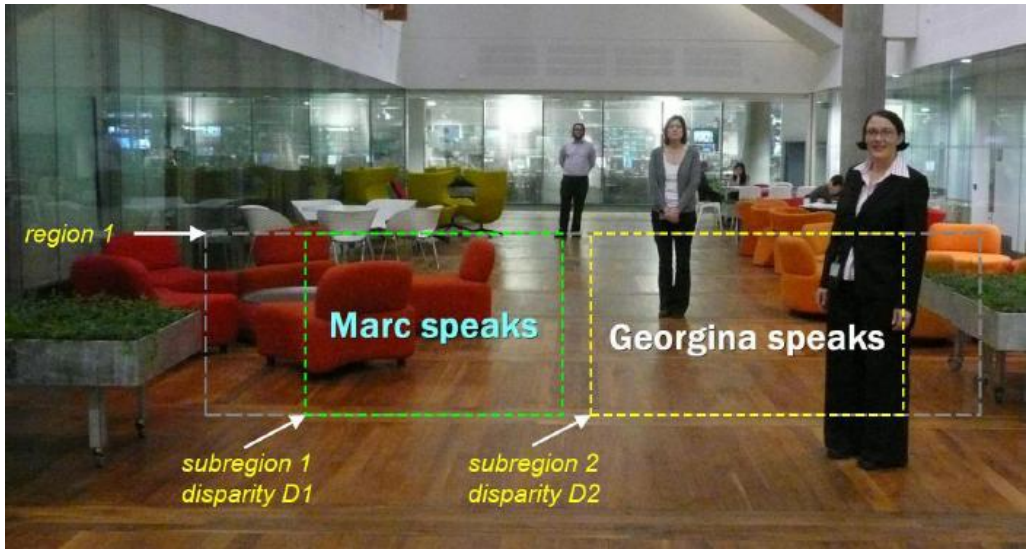
# 3D Workflow – Post-Production

- Special software or upgrades
- Stronger computing power
- More storage
- Subtitles (DVB Subtitling System standard ETSI EN 300 743)

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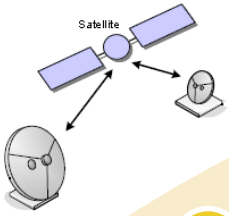
# 3D Workflow - Distribution

**S3D**




**Displaying**

Receiving

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# 3D Workflow - Distribution

- Bandwidth limitation:
  - ✓ DVB-T: 24 Mbit/s
  - ✓ DVB-T2: up to 45 Mbit/s (FEC 3/4)
  - ✓ DVB-S2: 45 Mbit/s
  - ✓ Internet: 80 Mbit/s
  - ✓ fibre channel: 120 Mbit/s

- Compression
  - ✓ MPEG –2: Legacy but bandwidth greedy → Increases noise in cascading while keeping details
  - ✓ H.264/AVC: state of the art and bandwidth saving → Reduces noise but also details and sharpness (filters)

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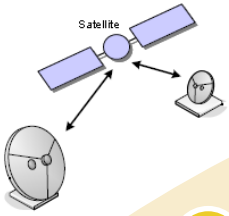
# 3D Workflow - Receiving

**S3D**




**Displaying**

Receiving

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# 3D Workflow - Receiving

| | Frame compatible | Service compatible |
|---|---|---|
| **pro** | 1) no need for sync<br>2) existing single link can be used | 1) full (HD) resolution on each eye<br>2) allows post-processing |
| **con** | 1) Half horizontal/vertical resolution<br>2) limited quality headroom | 1) Higher bandwidth<br>2) Sync signal needed |

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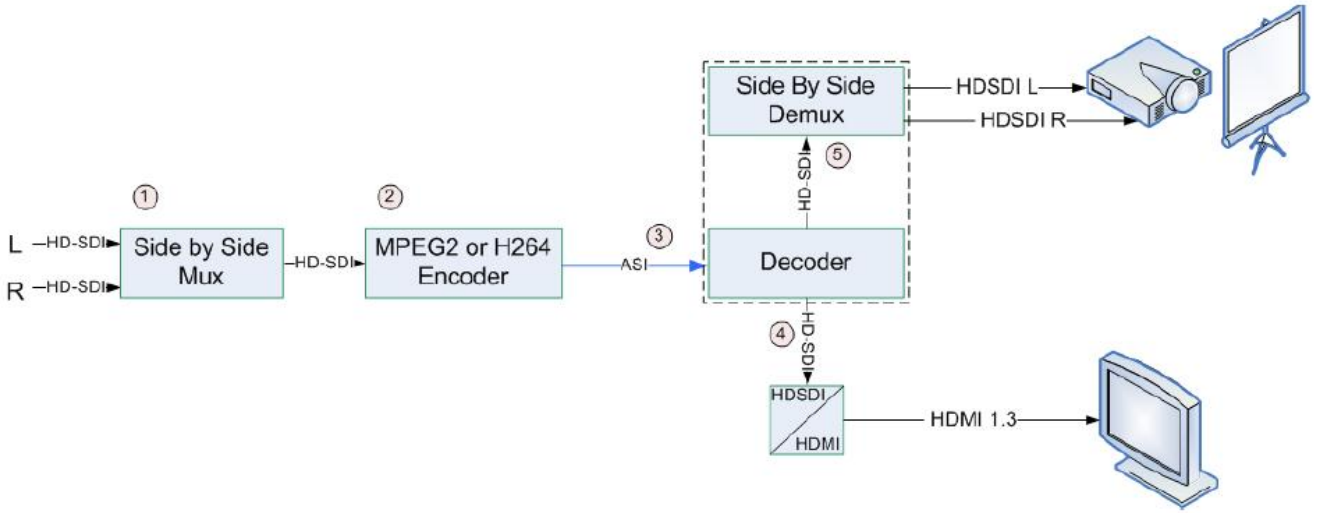
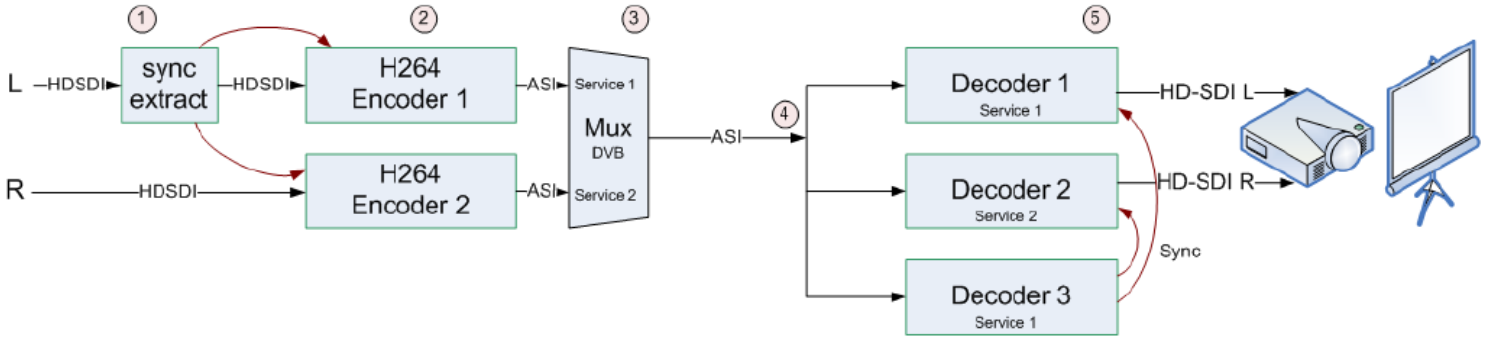
# 3D Workflow - Receiving

**Frame compatible**




**Service compatible**

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# 3D Workflow - Receiving

- DVB 3DTV Frame Compatible Formats
  - ✓ 720p@50, 60 - Top and Bottom
  - ✓ 1080i@25, 30 - Side by Side
  - ✓ 720p@50, 60 – Side by Side
  - ✓ 1080p@24 -Side by Side & Top and Bottom
- Why so many? There are circumstances where each of them will produce the highest quality results for the viewer!
- DVB 3DTV Service Compatible Formats could be (not defined yet):
  - ✓ 720p@50, 60
  - ✓ 1080i@24
  - ✓ 1080p@50,60

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# Stereo, MVD2, MVD4

Stereo

MVD2

MVD4

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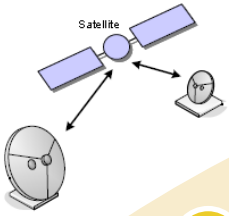
# Extrapolation

Inpainting process used in image extrapolation

# 3D Workflow - Displaying

**S3D**

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# 3D Workflow - Displaying

- New S3D displays with HDMI 1.4a interface
  - ✓ 2D
  - ✓ Stereoscopic display
  - ✓ Auto-stereoscopic display
  - ✓ N-view display
- DVB 3DTV standard in Phase1 is done: Frame compatible
- DVB 3DTV standard in Phase 2 is the next step: Service compatible
- 2D backwards compatibility: **DVB Phase 1 done, but...**

  ...reduces the spatial resolution of the L/R signal

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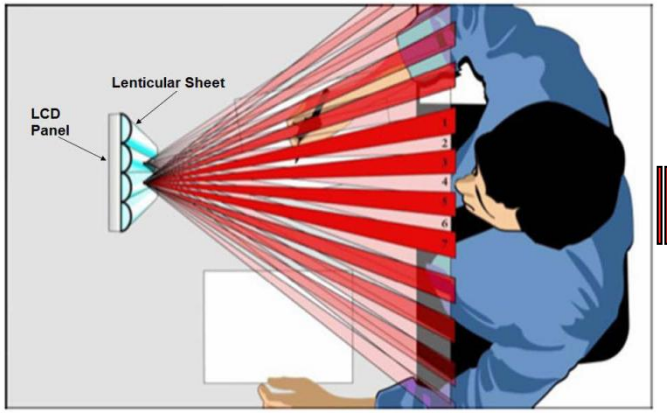
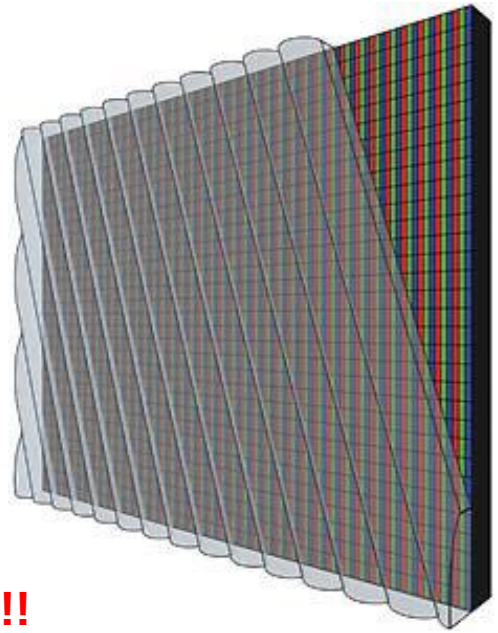
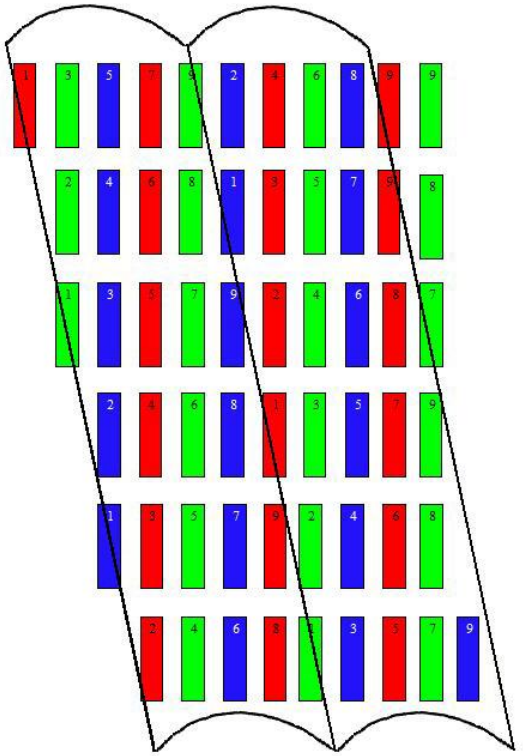
# 3D Workflow - Displaying

- The combination of a lenticular sheet/filter and LCD element provides an optically efficient way of making an electronic 3D display which does not require the viewer to wear special glasses

- Multiview Displays with 4k...8k are required to provide HD resolution for each eye!!!!





**PROBLEMS!!!**

# Summary of requirements

- ✓ Identify 3D image format and mode
- ✓ 2D backwards compatible
- ✓ Use current hardware/software where possible
- ✓ Best cost-benefit-ratio between bandwidth and comfort/quality
- ✓ Training and experience

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# What comes after?

- The content needs to be archived, but how?
- Archives are full of 2D → 2D to 3D converters are available, but...

  ...results vary from quite good to very bad – depending on the shot composition of the original 2D picture

**There will be the same issue like up-converted SD for HD, it's (always) visible.**

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# Progress and Implementation of 3D


- increase of sold 3DTV`s in Q1/11: +104%
  - ✓ expected in total in 2011: + ~460%
- 3D “super” hype is already going down, but stays at a certain consistent level
- 3D as a very nice additional feature next to the “normal” TV
- Standards are in progress and required through the whole chain of 3D

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# Progress and Implementation of 3D

- Today:
  - Producing good 3D content is still challenging except for animation
  - Frame compatible format is broadcasted (Mainly SbS 50i or 60i)
  - Full HD for both eyes only available on Blu-ray (MVC 24p)

- Tomorrow
  - More and more content producers have to be educated to produce good 3D
  - More comfortable content is required urgently
  - Trend to broadcast 2 full HD streams as one 3D image representation
    → but trade-off: bandwidth against resolution/quality/comfort

  - 2 approaches depending on broadcasters/operators businesses:
    - 3D transmission/displaying must be 2D backwards compatible
    - 3D transmission/displaying must be Frame Compatible Compatible /Service Compatible

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# Progress and Implementation of 3D

- Tomorrow:
  - QoE improvement
    - Depth tuning in post-production and in the home
    - 3D subtitling correct positioning in depth
    - Correct positioning in depth of graphics in STB and TV
      - Menus, EPG, Widgets,…
  - 3D audio (Ambisonics...)
  - Active glasses are expensive, battery based, not interoperable and generate flicker under ambient light
  - Current passive display technologies are not full HD
  - Display manufacturers working on new full HD passive technology
    - Active retarder on the screen plus passive glasses
    - Active glasses could disappear in 2 years from now
  - devices will become bigger and smaller at the same time

Source: http://www.pcinpact.com/actu/news/63822-eee-pad-memo-3d-android-30-honeycomb-7-pouces.htm


Source: http://www.geeky-gadgets.com/samsung-launches-75-inch-d9500-smart-tv09-05-2011/

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# Progress and Implementation of 3D

- The day after tomorrow
  - Glasses are a transition. Consumers won't accept them too long!
  - Autostereoscopic / Multi-view displays already sold for mobile and digital signage
  - higher frame rates and resolution (link to other technologies?)
  - Need for big displays as well but there are still big challenges
    - Increase the resolution (at least 4 times HD)
    - Increase the number of views, enlarge the sweet spot
    - Make them 2D backwards compatible (Switchable lens arrays)
    - Make the price affordable for consumers
    - Adapt 3D content production => MUSCADE
  - Most comfortable 3D content and technology available for consumers in 5 to 10 years according to various sources

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# Issues

- synchronization
- bandwidth
- standards
- infrastructure/workflow
- new STBs required for service compatible 3D or FCC (DVB)
- lacking/less knowledge of how to produce comfortable 3D content
- archiving

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# Issues

- **?** + (2 x 2D) = 3D
- Workflow automation is still missing
- Who says what good or bad S3D content is?

  → subjective evaluation: no methodology (ITU-R BT 500 for 2D) or reference
- display yet

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# Issues

- “human factor” + (2 x 2D) = 3D
- Workflow automation is still missing
- Who says what good or bad S3D content is?

  → subjective evaluation: no methodology (ITU-R BT 500 for 2D) or reference
- display yet

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# What is or will be done?

- ITU-R: Working Party 6C - Programme production and quality assessment
  - ✓ Special rapporteur on 3DTV production formats (A. Quested- BBC, B. Zegel-CBS)

- SMPTE: WG on 3D Home Master
  - ✓ Image format and its characteristics
  - ✓ Real time transport (Multi-link & Dual stream 3G) supported by SMPTE 292 (1,5 Gbit/s) and SMPTE 424 (3 Gbit/s) SDI interfaces

- 3D @ home consortium: five Steering Teams to...
  - ✓ cover human factors issues
  - ✓ Collect Standard Evaluation Material
  - ✓ test 3D glasses

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# What is or will be done?

- DVB: TM-3DTV & CM-3DTV
  - ✓ Phase 1: deploying 3DTV with existing HD broadcast infrastructure
  - ✓ Phase 2: deploying full res. 3DTV with two simultaneous streams (L/R) & subtitling and on-screen graphics
- HDMI: developed the HDMI 1.4a standard
- MPEG: 3D Video coding group & MPEG Frame compatible group
  - ✓ Call for Proposal will be evaluated in Nov. 2011
  - ✓ Coding solution for stereo full HD compatible with Frame compatible format
- ATSC: 3D-TV team to analyze standards for terrestrial broadcast 3D-TV delivery

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*We still need to be realistic and have to learn,*
*but we are on a very good way to create comfortable 3D.*

*If stick to the rules,*
*the content will become really comfortable*
*and offer an immersive experience to the audience.*

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# 3D workshop

- 6th & 7th October 2011 in Geneva, EBU
  - How do we process 3D?
  - Is S3D dangerous for children?
  - Are there some traps while producing, distribution or displaying S3D?
  - What are the medical aspects?

**http://tech.ebu.ch/events/s3d_technology_workshop**

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# And now my last slide for you...

## Thank you very much for joining the Webinar!!!

Questions?

thomas@ebu.ch

+41 (0)22-717 2704

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