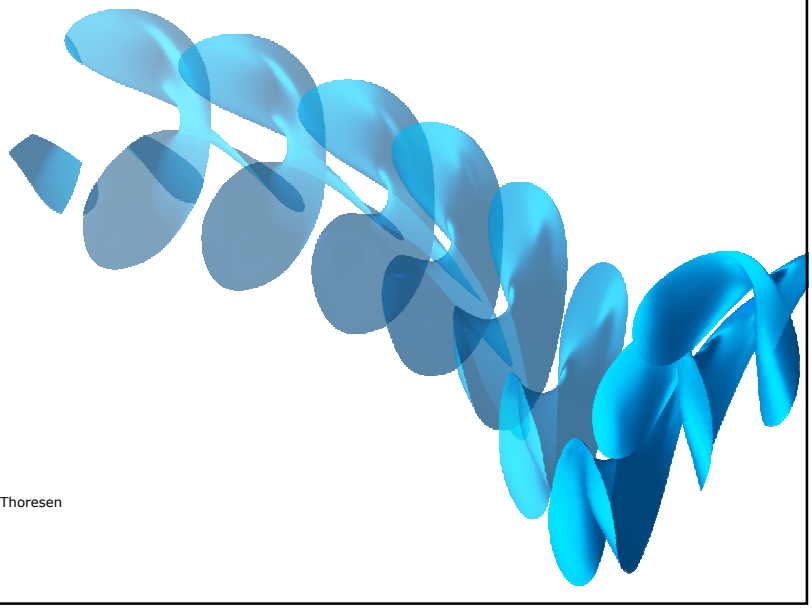


3DTV

Torkel Aamodt Thoresen
25.08.2011

Telenor Satellite Broadcasting

- Part of Telenor Broadcast, which again is part of the Telenor Group, one of the world's largest mobile operator (in terms of subscriptions)
- Prime orbital location at 1°West
  - THOR 5, THOR 6 & Intelsat 10-02
  - THOR 7 ordered (to be launched Q4 – 2013)
- Nordic market leader
  - 2.1 million satellite households in the Nordic region
- Emerging hotspot for CEE
  - 2.5 million DTH households in CEE *
- Increased cable head end reach position:
  - 5.8 million cable Nordic
  - 6.3 million cable CEE
- Delivering Head-end services for
  - DTH (270 services)
  - IPTV (430 services)
  - DTT (50 services)
- First 3DTV test transmission in May 2010
- First 3DTV fulltime service in September 2011

Stereoscopic images
- also called 3D….

- Illusion of depth in a 2D-image
- The viewer needs two eyes
- Need a filter, typically glasses
- Apr. 10 % cannot see stereoscopic TV

telenor group

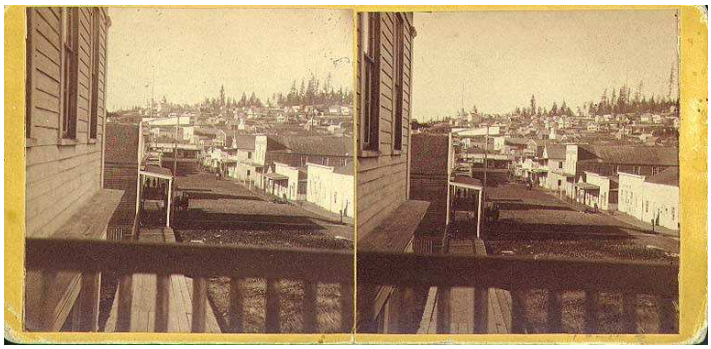
The development of TV
- a history of backwards compability

- Black-and-white television
- Color TV (owners of old TV's could still watch)
- Digital TV (owners of old TV's could still watch)
- HDTV (owners of old TV's could still watch)
- 3DTV (owners of old TV's could NOT watch)

telenor group

3D images is not new!

Invented by Sir Charles Wheatstone in 1840



1st Ave., Seattle, 1874

telenor group

3D movies

- First 3D feature movie was "Bwana devil" from 1952
  - Polarized system

telenor group

The DVB (Digital Video Broadcast)

The DVB project agrees specifications for **broadcast signal formats**

- Three stage DVB process:
  - What does it need to do to be a business success?
  - What technical specification can do that?
  - Does it do what we want?
- The ITU-R prepares **Reports and Recommendations**
- The EBU is looking at **production guidelines, and 2nd and 3rd generation 3DTV**

telenor group

3D television – standardizing

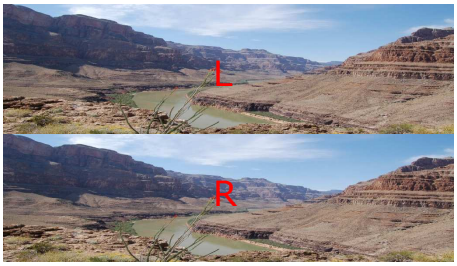
- DVB are working with standardizing of 3D for television
- Two working groups:
  - DVB-CM-3DTV
  - DVB-TM-3DTV
- Phase 1: Frame compatible mode
- Phase 2: Service compatible mode

telenor group

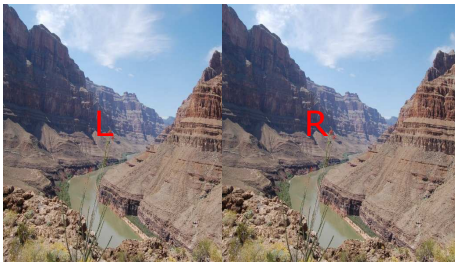
Phase 1 – Frame compatible mode

- Compiling right and left images in one HDTV-frame (1920 x 1080i)
- Reduces the resolution to 960 x 1080i @ 25hz (or 1920 x 540)
- The transmissions can only be used to for 3D (nearly, see next slide)
- Completed and issued by DVB. Go to www.dvb.org for download

Over / under



Side-By-Side

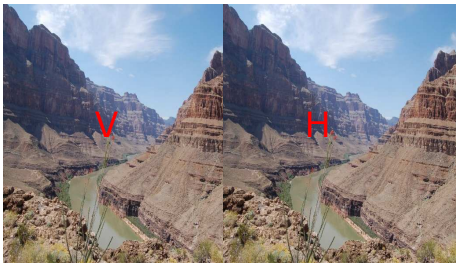


telenor group

DVB Fase 1 – Frame cropping

- Utilizing the ”Cropping rectange” function to stretch the frame
- Resolution is then reduced to 960 x 1080i @ 25 Hz (Standard Definition (SDTV) is 720 x 576i @ 25 hz)
- Not all STB’s and IdTV’s supprt ”Cropping”

Side-By-Side



telenor group

Phase 2 – Service compatible mode

- Transmitted as 2D, but with ancillary information for conversion to 3D
- Gives the full HDTV 1920 x 1080 resolution to each eye
- Can be backwards compatible with "normal" HDTV
  - Old settop boxer ignore the ancillary information
- The viewer can choose between "2D" and "3D"
- Same principle chosen for 3D Blu-ray Disc

telenor group

What are the issues for Phase 2 3DTV?

- How much 'more' do we need for Phase 2, to be successful?
- What quality level is needed?
  - normal 'HDTV' for L and R (720p/1280/50,60 1080i/1920/25,24 1080p/1920/25,24)?
  - 1080p/1920/50,60 for L and R?
- What compatibility is needed?
  - L, R separate ?
  - 2D HDTV reception ?
  - FC 3D-HDTV reception ?
  - Both of above ?
- Should there be provision for viewer depth range adjustment?
- Should there be both broadcast and download options?
- What sophistication for multimedia is appropriate?
- Should we wait for next generation compression (HEVC)?

telenor group

Encoding of 3DTV

Frame compatible mode

- Can use a normal H.264 HDTV encoder
- More bitrate is needed

Service compatible mode

- Several formats, some are available today, some are not
  - H.264 Simulcast
  - H.264 MVC Stereo High profile (like 3D Blu-ray)
  - H.264 MVC Multiview High profile
  - 2D + something (delta + depth maps + occlusion maps + …)
  - High Efficiency Video Coding (HEVC)

telenor group

HDMI 1.4a

- HDMI 1.4 defines formats between settop box and screen
- If a HDMI source (settop box) can transmit 3D video, then it have to be able to transmit at least one of the following

Frame packing:

- 1920 x 1080p @ 23.98 / 24Hz
- 1280 x 720p @ 59.94 / 60Hz
- 1280 x 720p @ 50Hz

Side-by-Side (Half):

- 1920 x 1080i @ 59.94 / 60Hz
- 1920 x 1080i @ 50 Hz

Top-and Bottom:

- 1920 x 1080p @ 23.98 / 24Hz
- 1280 x 720p @ 59.94 / 60Hz
- 1280 x 720p @ 50Hz

Source: High-Definition Multimedia Interface Specification Version 1.4a Extraction of 3D Signaling Portion

- The screen must support all

telenor group

HDMI 1.4a - What's missing?

Backwards compatible with HDTV requires 1080i @ 50 and 59,94 / 60 Hz

Future would require 1080p @ 50 and 59,94 / 60 Hz

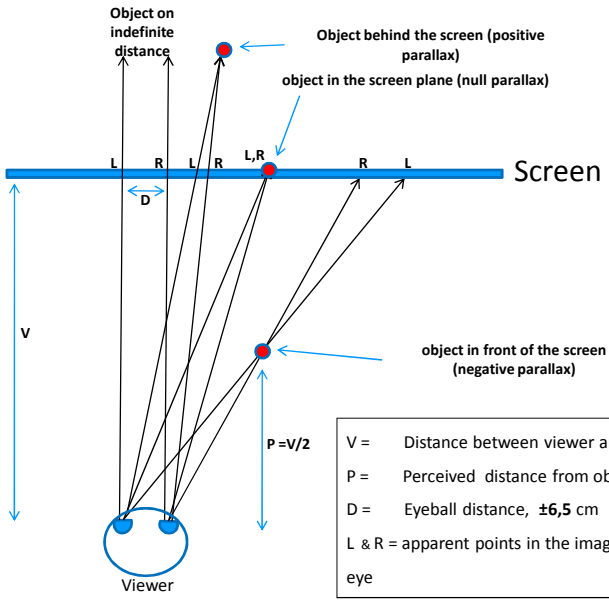
So we need:

Frame packing:

- 1920 x 1080i @ 59.94 / 60Hz
- 1920 x 1080i @ 50Hz
- 1920 x 1080p @ 59.94 / 60Hz
- 1920 x 1080p @ 50Hz

These are Primary formats, but not Mandatory formats in HDMI 1.4a

telenor group



V = Distance between viewer and screen

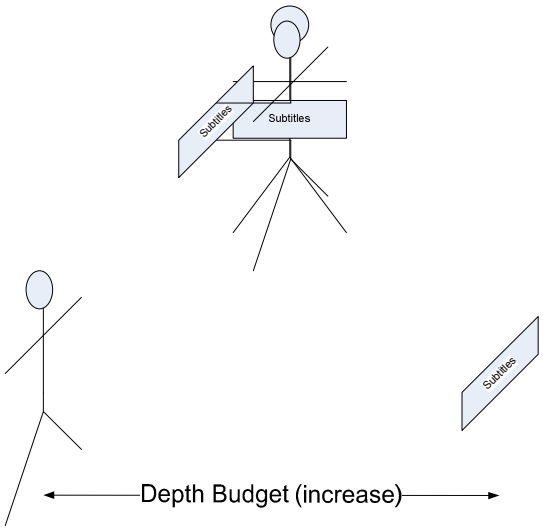
P = Perceived distance from object to viewer

D = Eyeball distance, **±6,5** cm

L & R = apparent points in the image from left and right eye

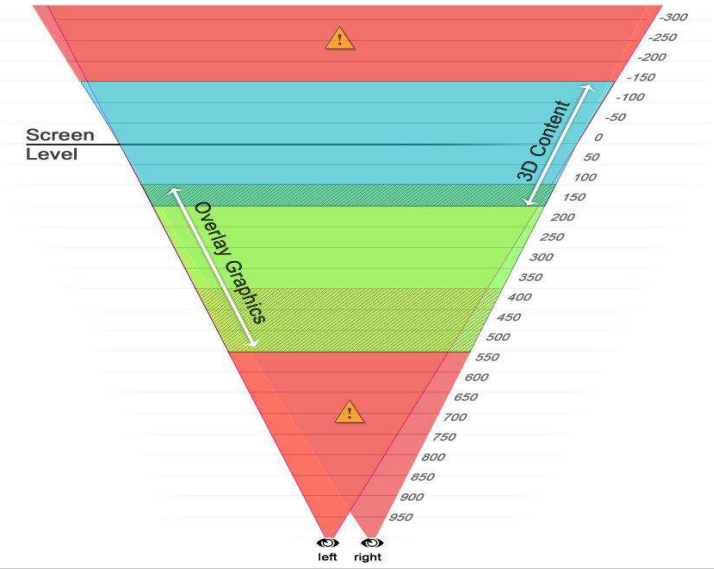
telenor group

Subtitling and graphics – where to place them?



telenor group

Depth control – why may we need it?



telenor group

Questions?

telenor group