

# 3D IPTV

## *Networking technologies and impact*



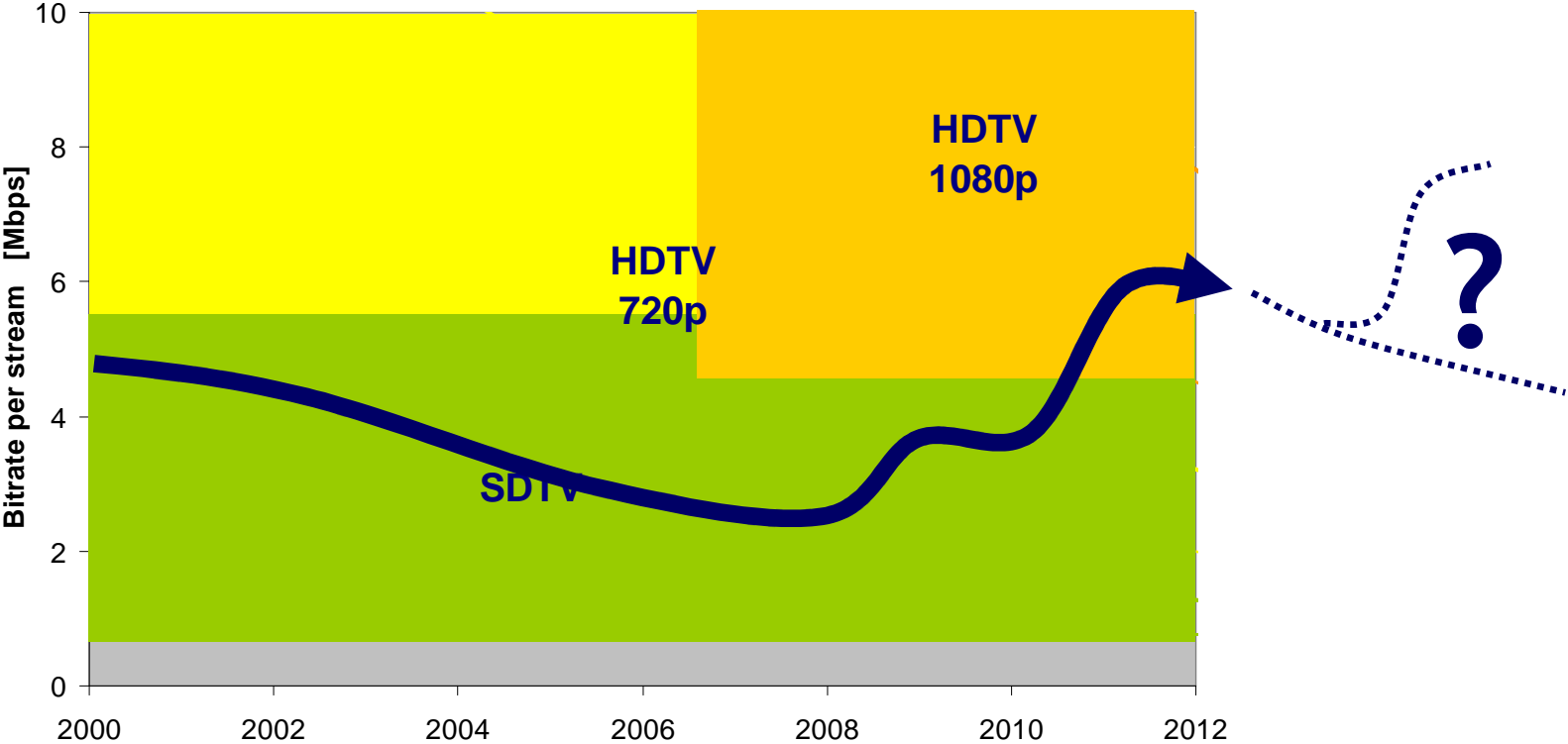
Donny Tytgat -- Bell Labs, Research



Video Technologies

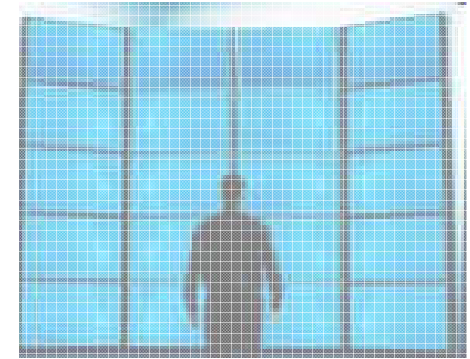
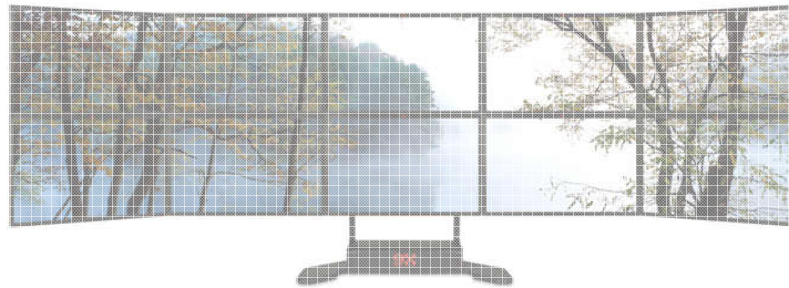
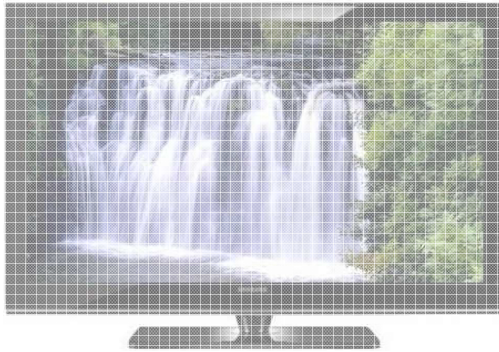
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# Evolution in Screen technology

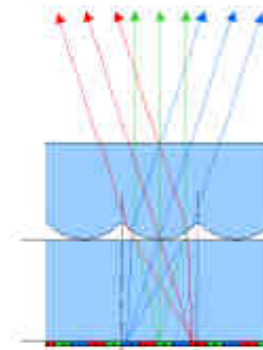


# 3DTV: a possible future evolution?

## Bigger Screens -- Higher Resolution ?



## Adding a new dimension: 3D IPTV



# How does 3D coding works: Overview

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## Different Alternatives currently used & under study

- 2D + Z coding
- Multi-viewpoint coding (MVC)
- Multi-viewpoint + depth (MVD)

## Not a uniform technology yet for 3D media encoding & transmission, due to:

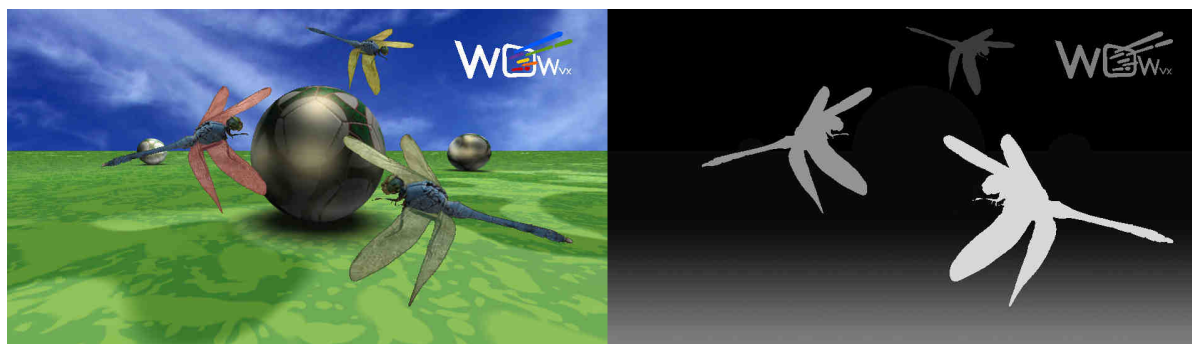
- Advantages & disadvantage of each technology related to used visualization technology & acquisition
- New applications are still in research phase (requirements too pre-mature)

# How does 3D coding works: 2D+Z

(1)

## 2D+Z is a bandwidth efficient format for coding semi-3D content

- For a certain scene both 2D and depth information is provided
- Initial standardization ongoing in MPEG-C part 3



## *2D+Z Encoding*

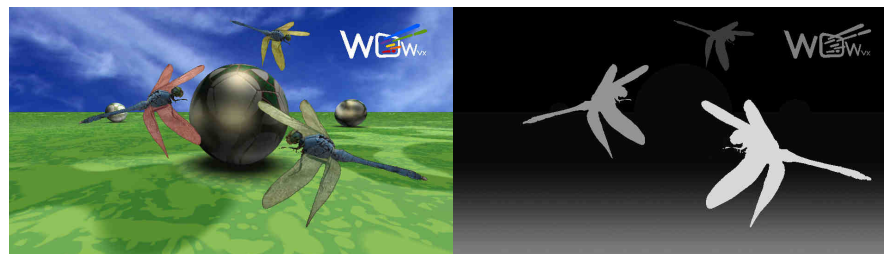
### Advantages:

- Backwards compatible with normal 2D TVs
- Easy to get data from synthetic content (Z-buffers)
- Nearby views can be easily extrapolated using this depth information
- 10-20% overhead compared to 2D MPEG Bandwidth

## How does 3D coding works: 2D+Z

(2)

2D+Z is a bandwidth efficient format for coding semi-3D content



**2D+Z Encoding**

### Disadvantages:

- High processing required for generating depth-map from captured scenes
- Not possible to see occluded areas (You cannot look behind a corner)
- Occluded areas introduce annoying visual artefacts (Round edges and in high frequency parts of the depth-map)
- Not suitable for visualisation systems with large viewing angles

**Updates are under investigation to also add occluded information for reducing visual artefacts**

## Multi-viewpoint coding

- If 2 or more viewpoints are send over the network
- Nearby views have lots of similarities.



## *Multi Viewpoint Coding*

- Taking similarities into account will reduce the BW

$$BW_{MVC} < n \times BW_{single\_viewpoint}$$

- Multi-viewpoint standardization is currently ongoing in JVT: as a extension to H.264/AVC

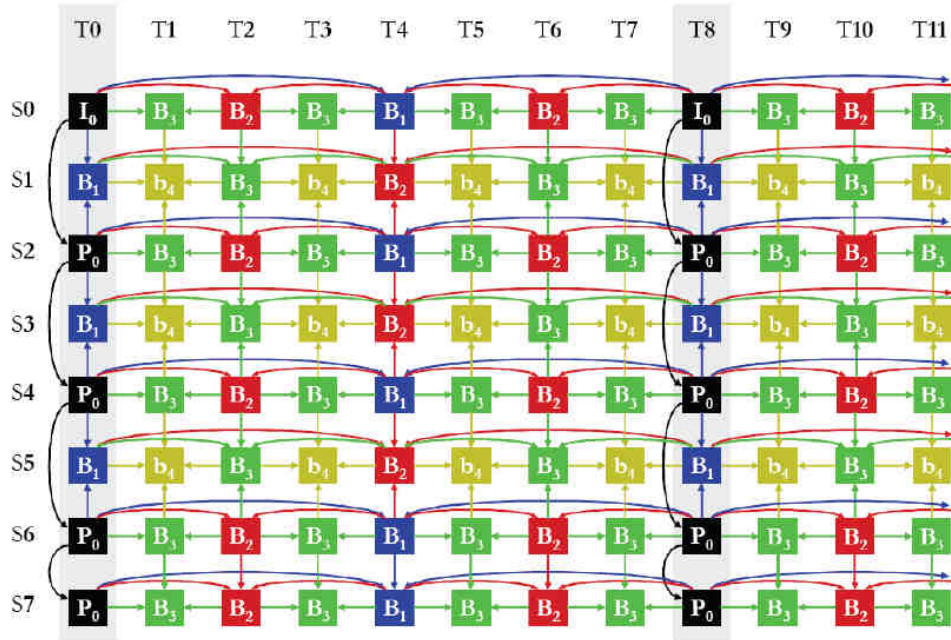
# How does 3D coding works: MVC

(2)

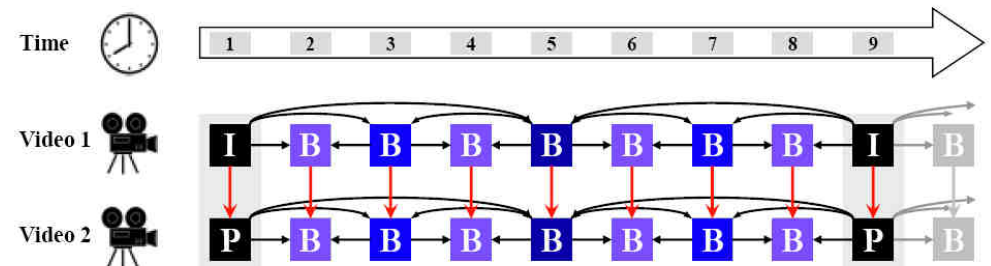
## H.264 Multi-viewpoint coding:

- Hierarchical B-frames mechanisms is used for doing predictions between viewpoints

*Example scheme for 8 viewpoints*



*Example scheme for stereo*



## Multi-viewpoint coding

### Advantages:

- No view interpolation is required for visualization technologies which require the raw views (e.g. glasses, parallax barrier,...)
- Occluded areas are recorded as well
- With multiple views (e.g. 8) large viewing angle can be covered



### Disadvantages:

- High processing power is required if viewpoint interpolation is necessary
- Higher bandwidth requirements, depending on occluded information
- Expected bandwidth of 30%-80% per layer/viewpoint compared to 2D AVC Bandwidth

# How does 3D coding works: Multi viewpoint + Depth

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## Multi Viewpoint + Depth (MVD):

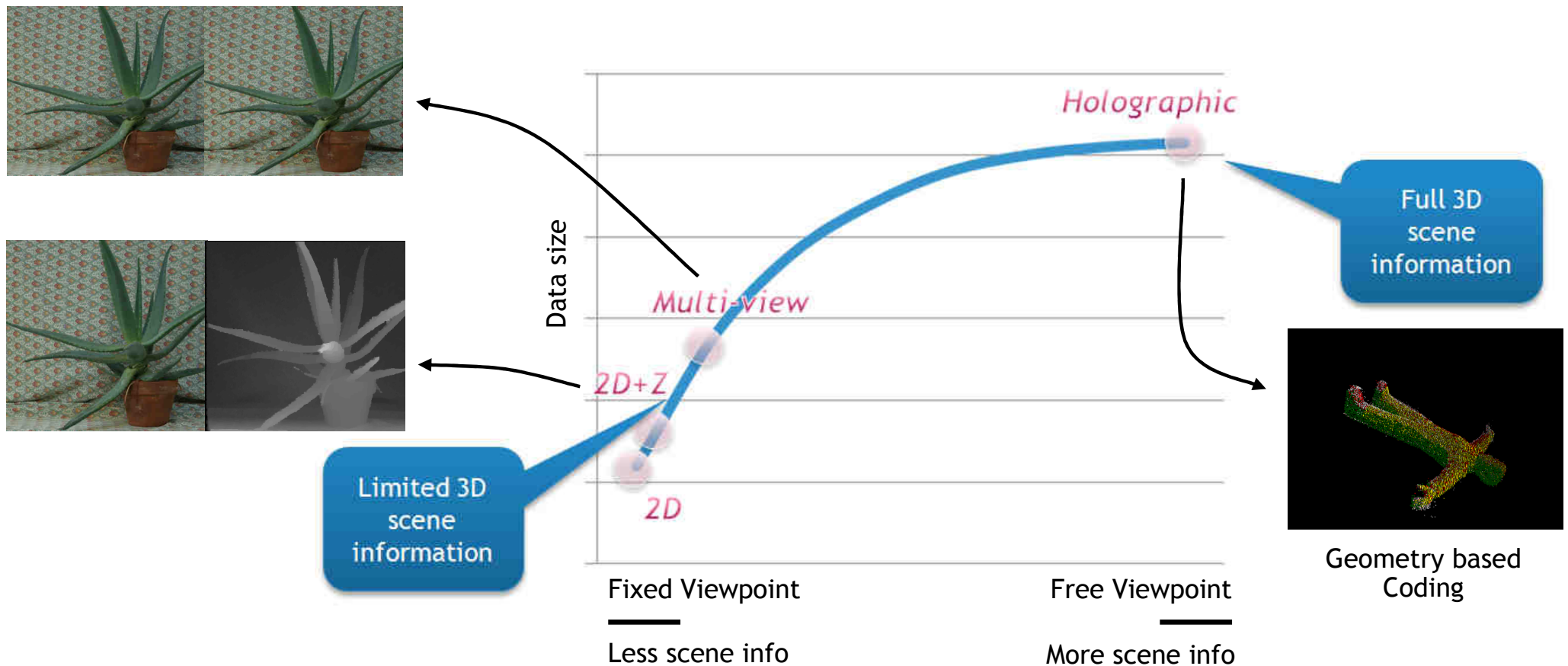
- Combination of 2D+Z and MVC
- Multiple viewing angles are provided each with their depth-map



- Requires less viewpoints & bandwidths than MVC (e.g. 3 views iso. 8)
- Better quality for occluded areas
- Larger viewing angle
- Intermediate views can easily be interpolated
- Can be compatible with multiple visualization technologies

# What's the future of 3D Coding

Most 3D displays are still very limited in the 3D viewing angle they provide  
as this evolves, the required information of the scene increases



# Evolution towards full 3D

Applications and services are also evolving towards 3D

Virtual worlds are becoming increasingly popular

Gaming, social networking, professional collaboration, etc.

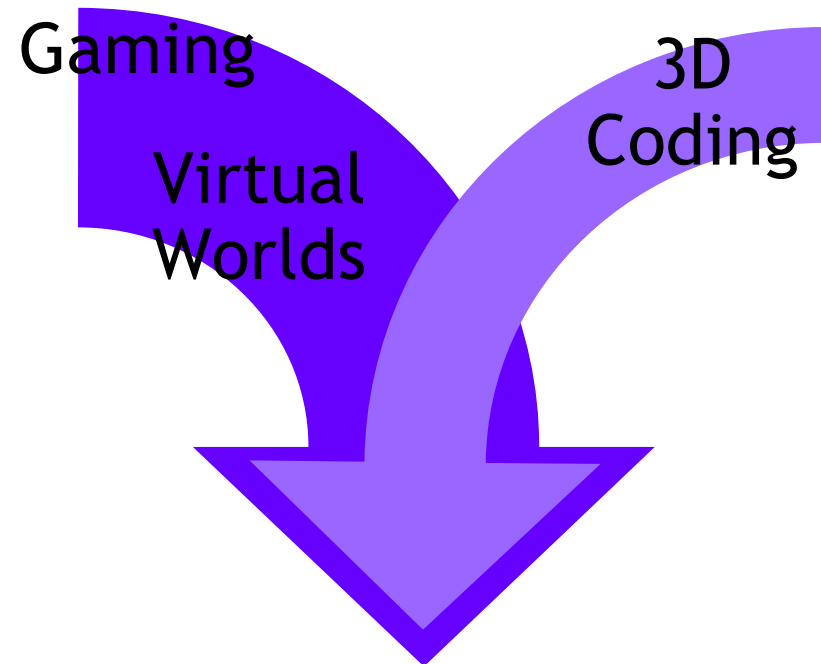
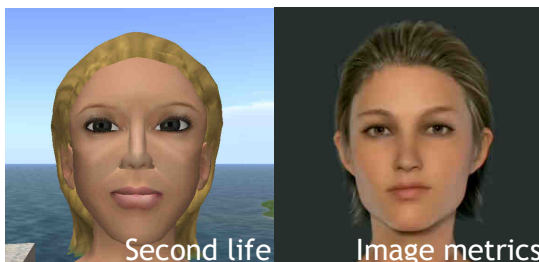
*User generated content*



*Dynamic interactions*



*Increasing 3D model quality*

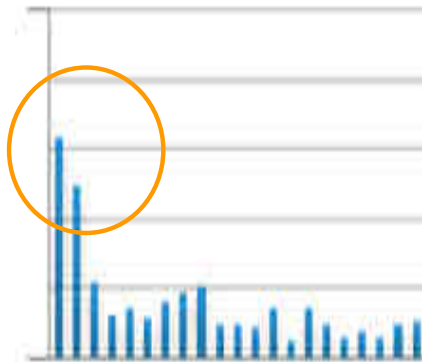


# Impact on the network

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## Impact of future 3D coding technologies

- Coding gain will increase due to new geometry based encoding technologies
  - Requirement of low-latency, for allowing interactivity, might on the other hand put a limit to coding gain
- Average Bandwidth will still increase, but will probably not explode
- However Peak Bandwidth will become a more important issue



Future coding will need more state information, e.g.

- ⇒ 3D Model information
- ⇒ Texture/Material information

# Conclusions

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- 3DTV technologies is new user-experience / opportunity for IPTV
- Screen technologies become more and more mature
- 3D Coding technologies are following this wave, however still in their initial shoes
  
- 3DTV will probably have moderated impact on average network bandwidth
- Future 3D coding will probably have higher impact on required peak bandwidths

## Future opportunities:

- Convergence of 3D entertainment, Gaming & 3D Virtual Worlds
- New evolutions in IPTV Human - Machine interfaces

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