



# HDTV

## Today and Tomorrow

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ZetaCast

# Who is ZetaCast?

Independent technology consultancy company

- Specialising in digital TV

ZetaCast directors have each over 15 years experience of digital TV, including

- Leading development of the world's first broadcast-quality MPEG-1 decoder
- Leading design team for the world's first real-time MPEG-2 encoding system
- System integration and project management for digital terrestrial, cable and satellite systems



# Overview of the Presentation

HDTV Today

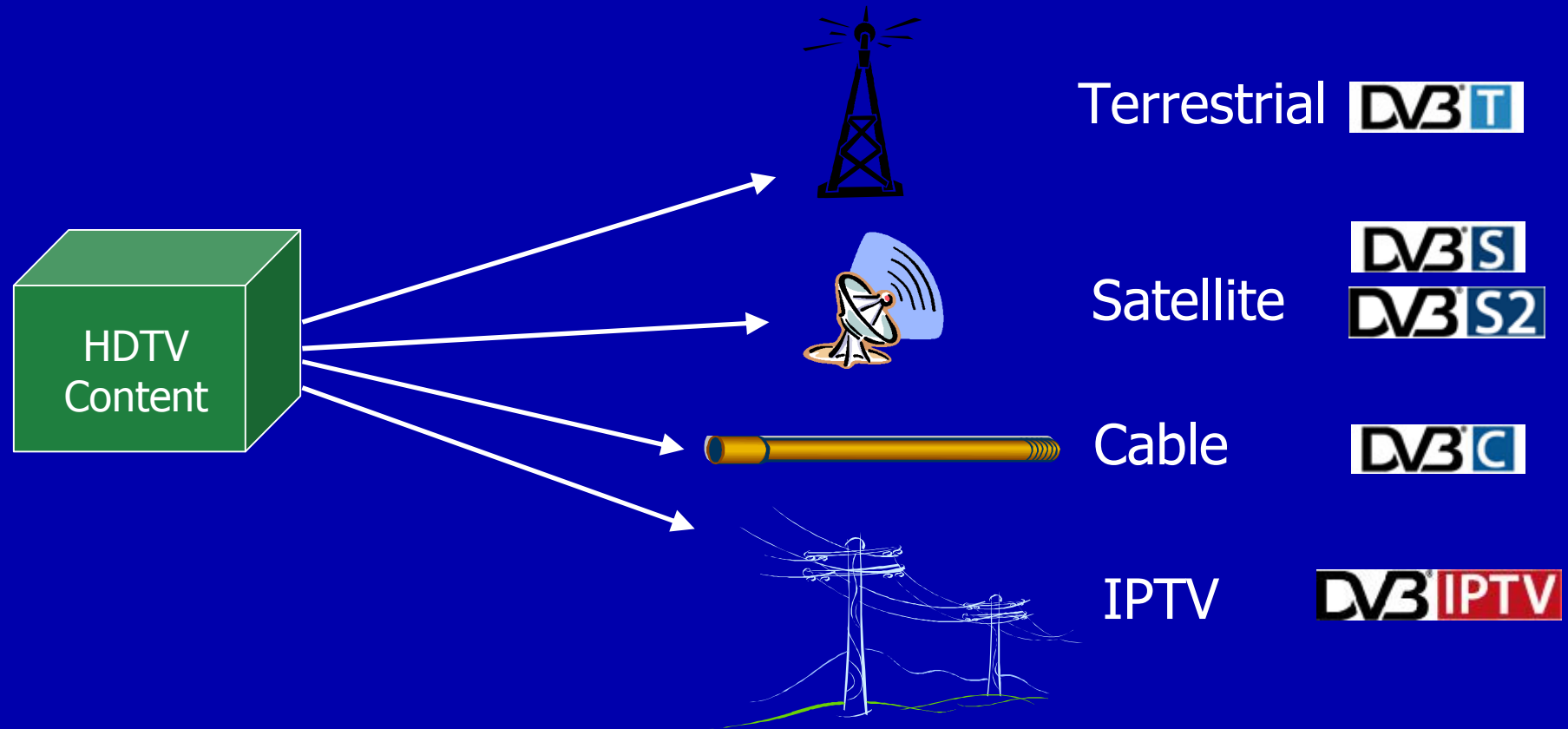
HDTV Tomorrow

Predictions

Demonstration



# HDTV Delivery Options



# HDTV via Terrestrial

HDTV in the DVB World was first launched in Australia in 2001 using DVB-T

- | MPEG-2 video coding

In Europe, HDTV was not the initial focus

- | Recent terrestrial HDTV trials in several European countries
- | H.264/AVC video encoding

Spectrum is key limiting factor for terrestrial HDTV

- | Major HDTV deployment may have to wait until after analogue switch-off
- | Competition for released spectrum from other uses



# HDTV via Satellite

Satellite delivery has lead the way in the launch of HDTV in Europe

Major European satellite broadcasters launched in 2006

- | Germany: Premiere
- | France: Canal+ and TPS
- | Italy: Sky Italia
- | UK and Ireland: BSkyB

All use a "second generation" DVB satellite system

- | DVB-S2 transmission
- | H.264/AVC video compression coding

# HDTV via Cable

Cable is not far behind satellite

Major European cable operators launched in past year

- | Netherlands: UPC
- | UK: Virgin Media

Most use a "second generation" DVB cable system

- | 256 QAM mode of DVB-C
- | H.264/AVC video compression coding



# HDTV via IPTV

IPTV services use advanced delivery and compression

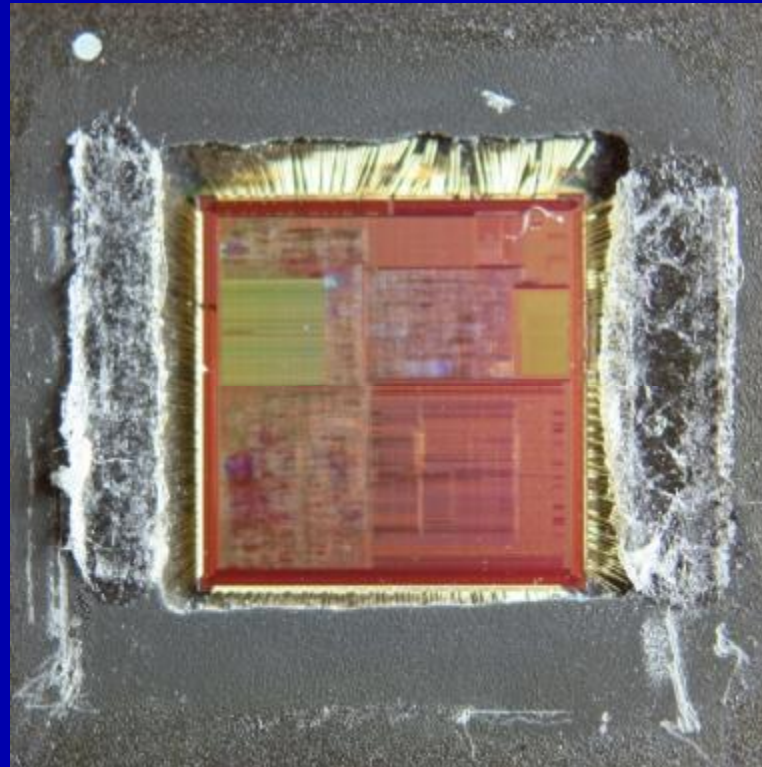
- | ADSL2+, VDSL or DOCSIS 3 delivery
- | Advanced compression coding

DVB IPTV specifications are being developed in 2 phases:

- | Phase 1 has an MPEG Transport Stream on top of IP
- | Phase 2 is delivered directly over IP protocols
- | Most current IPTV services use the first approach



# Single Chip H.264/AVC HDTV Encoder



HDTV encoder chip from Ambarella Inc.

# HDTV Video Formats

Two transmission formats:

- | 720p/50-60
  - u 720 lines x 1280 pixels at 50 or 60 frames/s (progressive)
- | 1080i/25-30
  - u 1080 lines x 1920 pixels at 25 or 30 frames/s (interlaced)

A third format starting to be used for production:

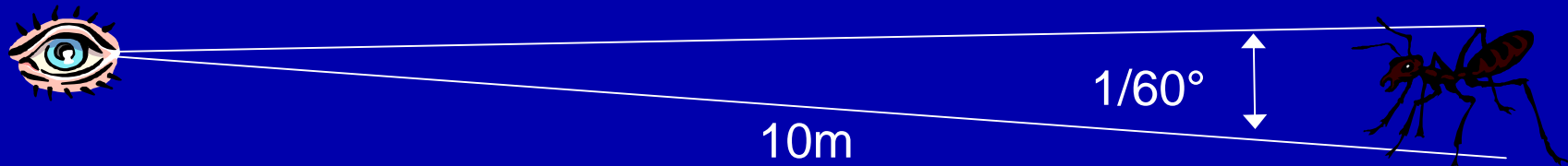
- | 1080p/50-60
  - u 1080 lines x 1920 pixels at 50 or 60 frames/s (progressive)



# What resolution is actually needed?

Minimum visible object subtends an angle of around 1 minute of arc

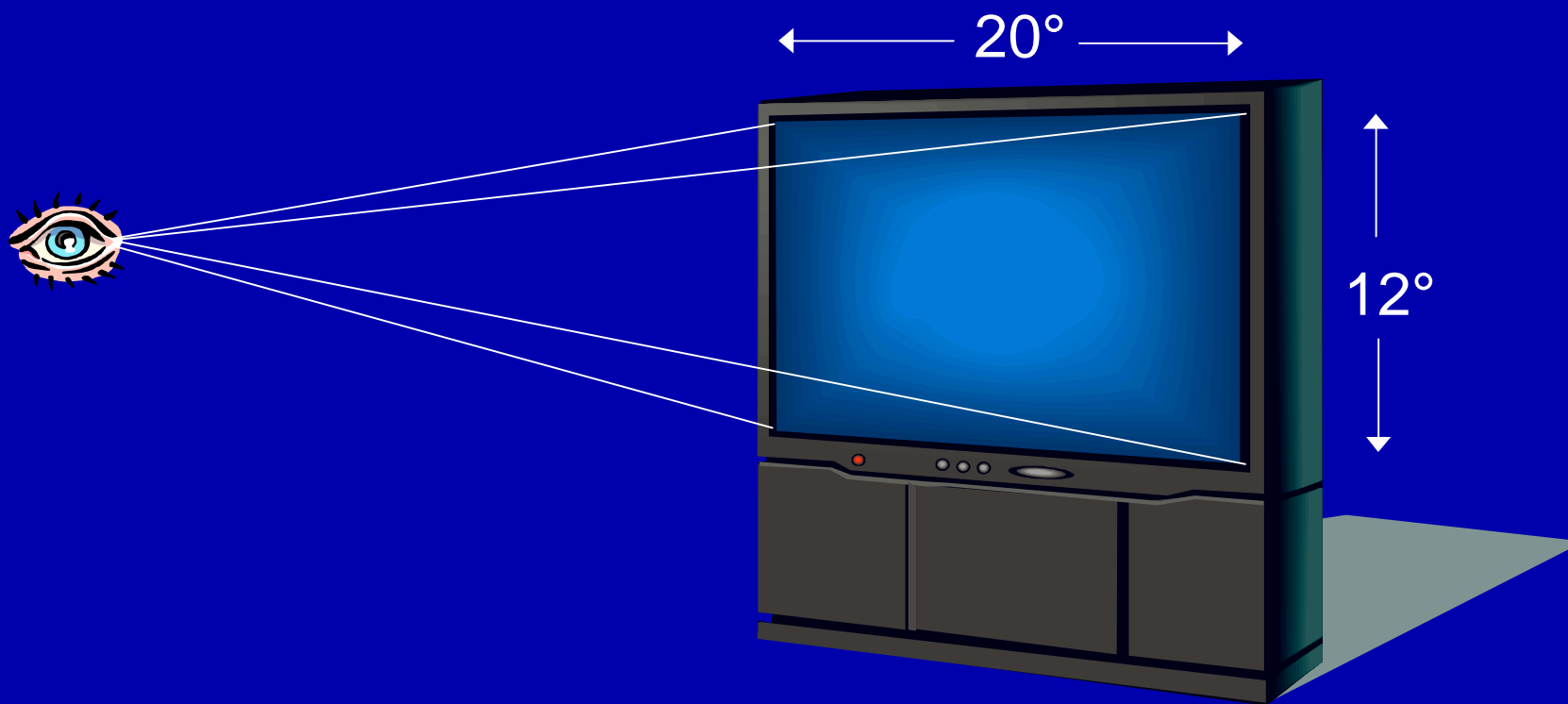
- ┆ Roughly corresponds to looking at an ant from 10m



Finer detail is not perceptible

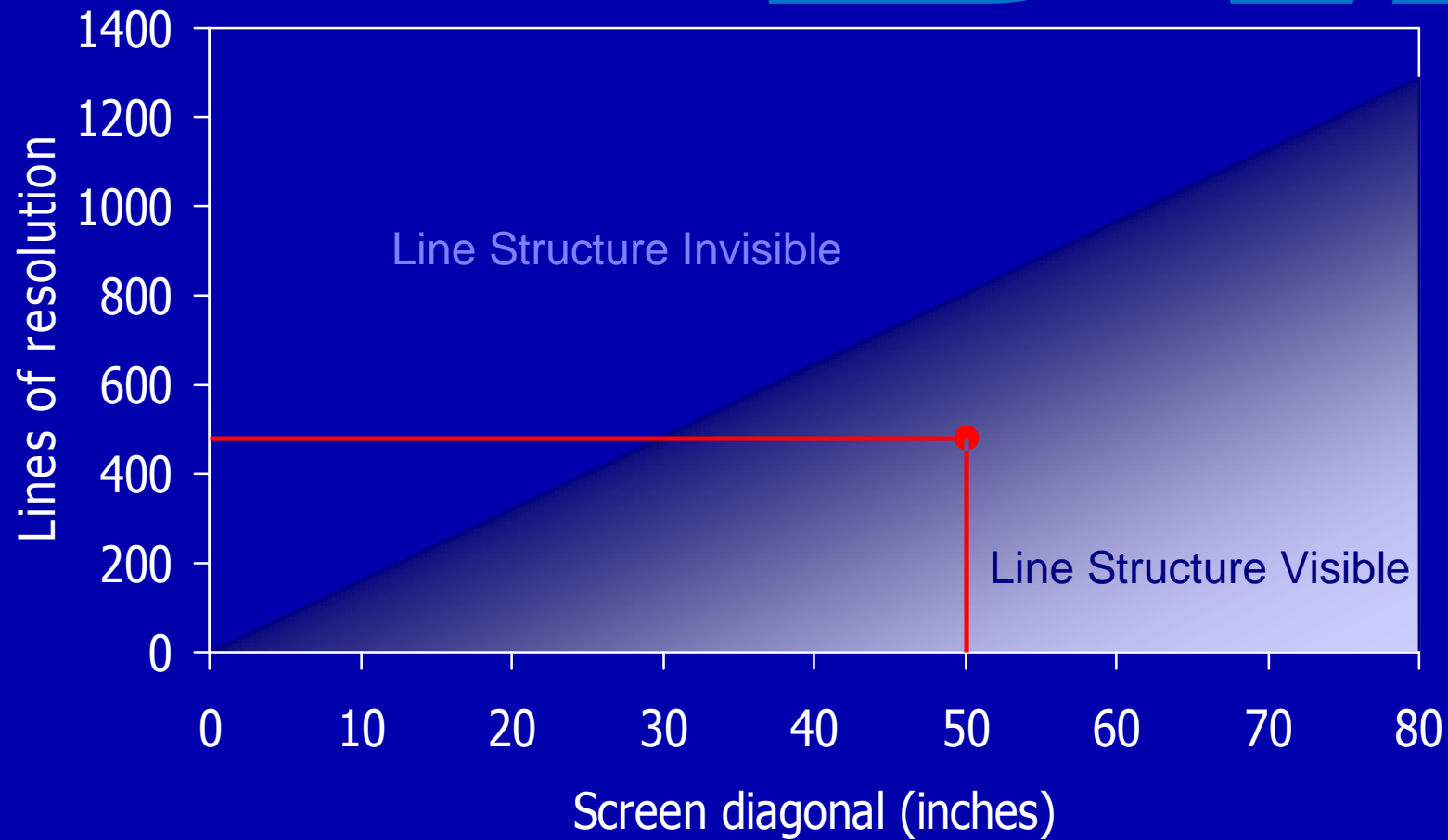
- ┆ HDTV line structure invisible if each line  $< 1/60^\circ$

# Maximum Viewing Angles for 720p



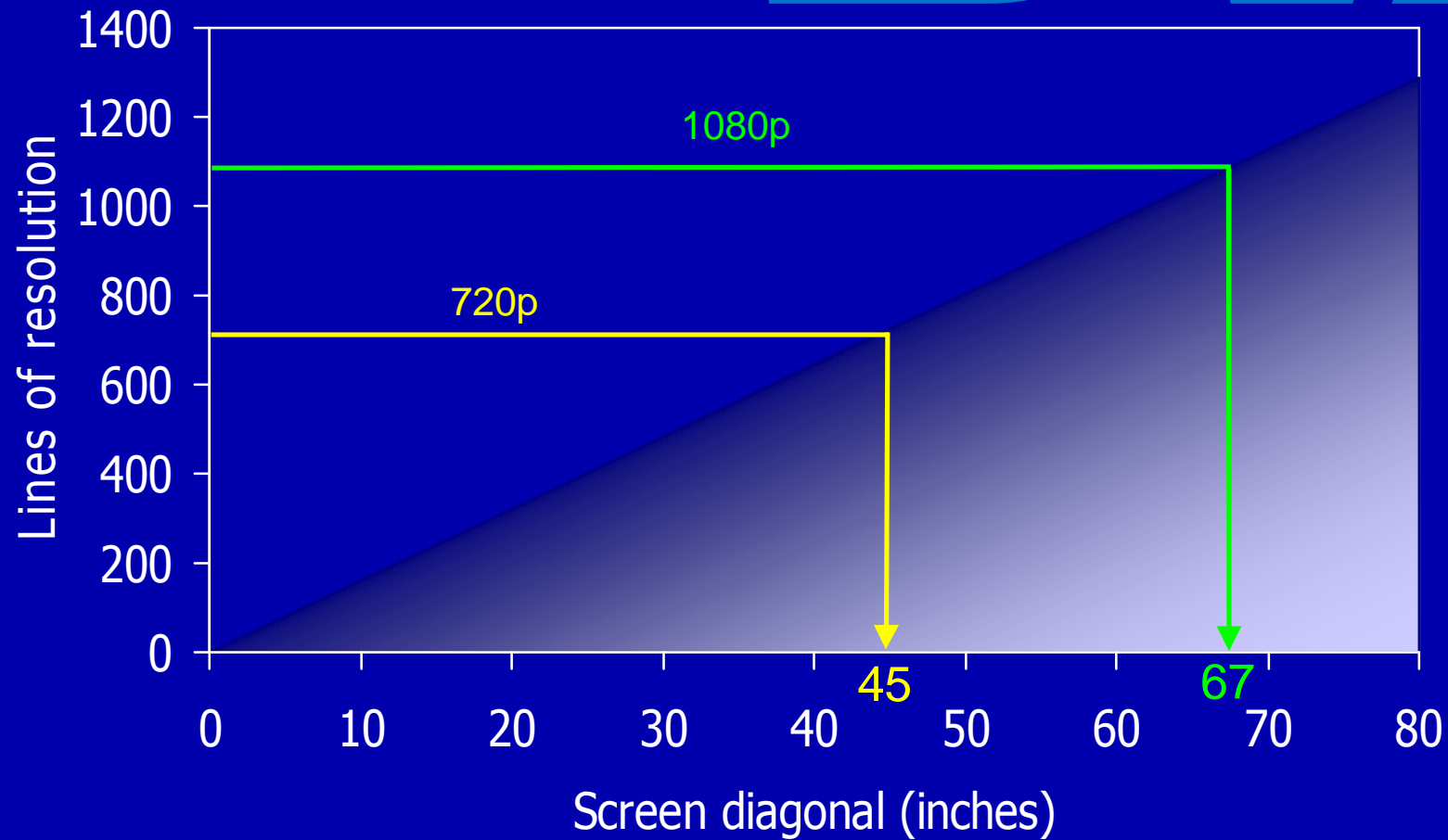
# Resolution and screen size

Viewing from 2.7m

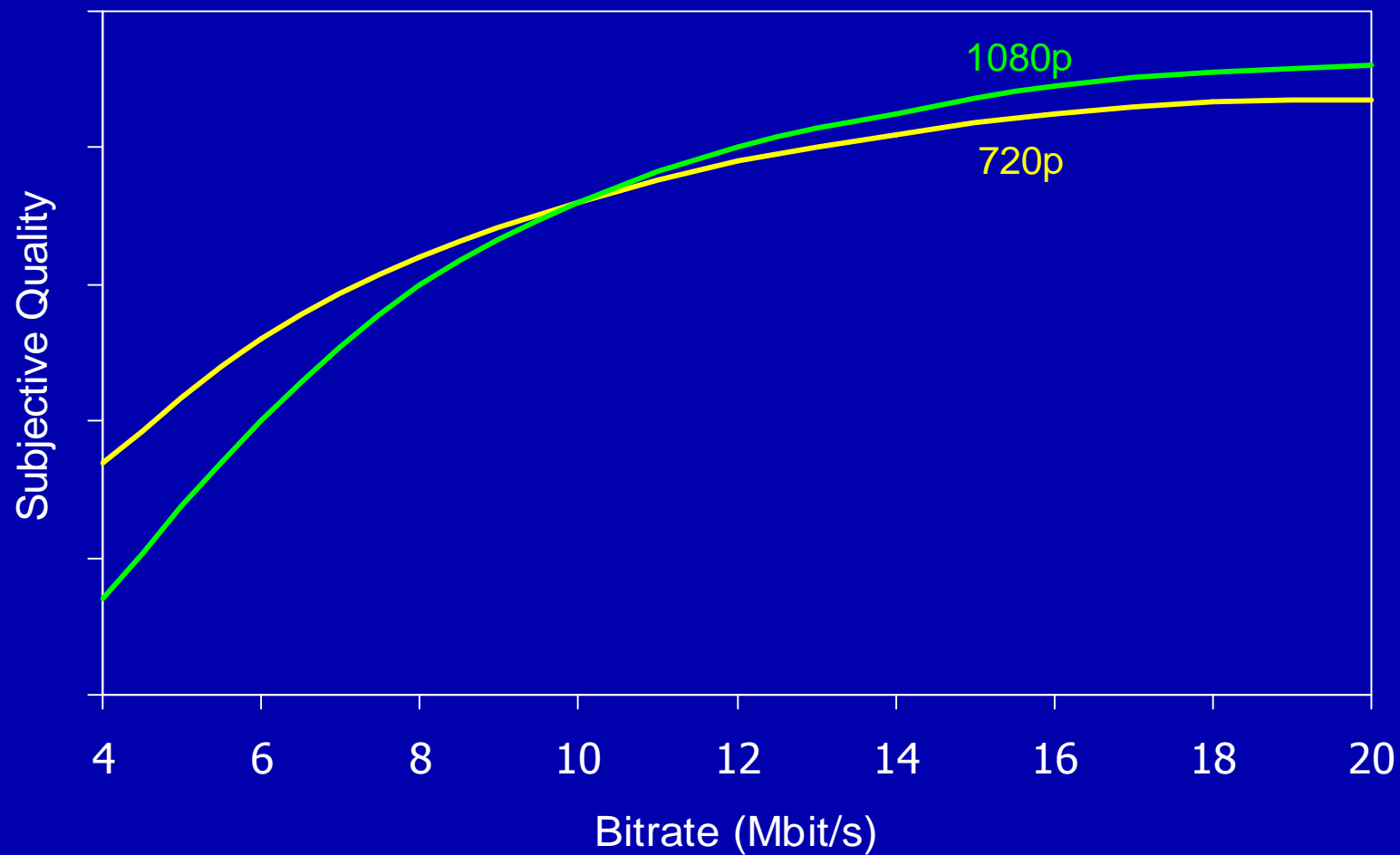


# Resolution and screen size

Viewing from 2.7m



# Subjective Quality versus Bitrate



# Will 1080p be used for HDTV Transmission?

## Pros:

- | 50% bigger displays than 720p without visible line structure
- | Bit-rate not significantly higher than for 1080i
- | Content will be shot in 1080p/50-60

## Cons:

- | Decoder needs double memory bandwidth
- | Legacy of deployed HD receivers can't decode 1080p
- | Higher bit-rate than 720p needed to avoid coding artefacts

## The market will decide

- | Is quality improvement enough of a step change to introduce a new consumer format?
- | Is sufficient bit-rate available?



# Ultra HDTV

Format	Maximum horizontal viewing angle (approx)
720 lines x 1280 pixels (720p/50-60)	20°
1080 lines x 1920 pixels (1080p/50-60)	30°
2160 lines x 3840 pixels	60°
4320 lines x 7680 pixels	100°

# Lies, Damned Lies and Predictions

I made some predictions at DVB World 2006:

*Bit-rates required for advanced compression of HDTV will improve significantly in the coming year*

- | *More of the new tools in the compression algorithms will be implemented in encoding hardware*
- | *Better understanding of the new algorithms allows the encoders to be better tuned*
- | *Virtuous circle of statistical multiplexing*

*Bit-Rates for HDTV by DVB World 2007*

- | *About 8 – 10 Mbit/s for 1080i*
- | *About 6 – 8 Mbit/s for 720p*



# Have these Predictions been Met?

Not quite for production encoders today...

...but some good progress in the right direction

Judge the progress for yourselves with the demonstration of "consumer" H.264/AVC encoding at 8Mbit/s

With thanks to:

