Digital Television: The MPEG-2 Standard

Gorry Fairhurst
Department of Engineering
University of Aberdeen
G.Fairhurst@eng.abdn.ac.uk

video MediCAL JTAP 2/288 Funded by the Joint Information Systems Committee

esa

Performance Optimisation of Internet Protocols via Satellite

Not a tutorial on compression techniques !

Why Compress?

The future of TV is digital

PAL TV → **216 Mbps**

HDTV TV → **1 Gbps**

Why MPEG-2?

MPEG-2:

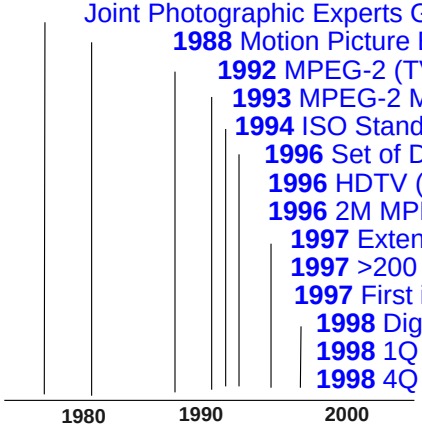
- Adopted as industry standard for TV
- Adopted as industry standard for 16:9 HDTV
- Capable of a range of extra services

The future is MPEG-2 !

History of MPEG

G Fairhurst

Work in digital compression lead to DCT algorithms
Joint Photographic Experts Group (JPEG) active
1988 Motion Picture Expert Group (MPEG) formed
1992 MPEG-2 (TV) and MPEG-3 (HDTV) combined
1993 MPEG-2 Main profile defined (compat MPEG-1)
1994 ISO Standard 13818 for MPEG2
1996 Set of DVB standards published by ETSI
1996 HDTV (1250/50) demonstrated in 16:9
1996 2M MPEG-1 video disk players in China
1997 Extended CPU graphics instruction sets
1997 >200 DVB Satellite TV Channels
1997 First interactive DVB service
1998 Digital Versatile Disk (DVD)
1998 1Q Active Movie API
1998 4Q Launch of DVB-T in UK



Why Standardise?

G Fairhurst

Advantages

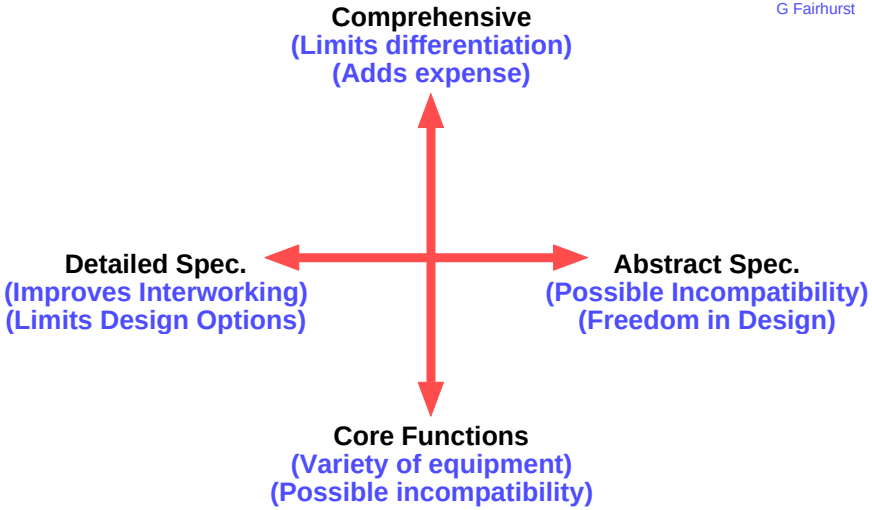
- Build consumer confidence
- Provide choice of similar products
- Allow mass production of component items
- Allow new services to reuse existing technology

Disadvantages

- Tie products to specific technology
- Reduce product differentiation
- Do not always match user needs

How much to Standardise?

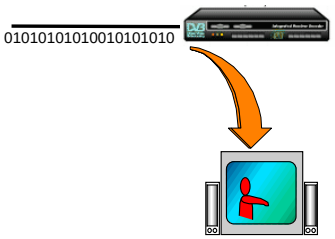
G Fairhurst



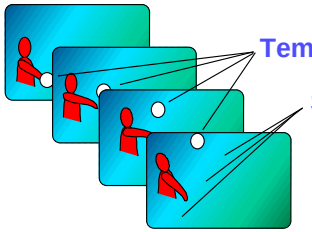
MPEG-2 Features

G Fairhurst

- Backwards compatible with MPEG-1
- Full-screen interlaced and progressive video
- Enhanced audio coding
- Transport multiplexing (MUX)
- Other services (GUI, interaction, encryption, etc)

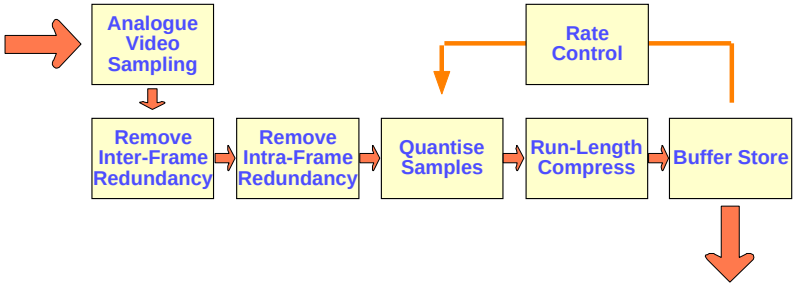


MPEG Compression



Temporal redundancy (inter-frame)

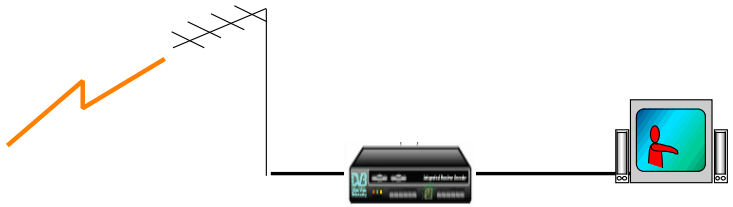
Spatial redundancy (intra-frame)



Typical Transmission Rates

< 0.384 Mbps	Video conference	(MPEG-4)
<1.5 Mbps	Video in a window	(MPEG-1)
1-2 Mbps	VHS quality full screen	(MPEG-2)
2-3 Mbps	Broadcast NTSC	(MPEG-2)
4-6 Mbps	Broadcast PAL	(MPEG-2)
8-10 Mbps	Professional PAL	(MPEG-2)
12-20 Mbps	Broadcast HDTV	(MPEG-2)
27.5-40 Mbps	DVB satellite multiplex	(MPEG-2 Transport)
32-40 Mbps	Professional HDTV	(MPEG-2)
34-50 Mbps	Contribution TV	(MPEG-2-I)
140 Mbps	Contribution HDTV	(MPEG-2-I)
168 Mbps	Raw NTSC	(uncompressed)
216 Mbps	Raw PAL	(uncompressed)
270 Mbps	Raw contribution PAL	(uncompressed)
1-1.5 Gbps	Raw HDTV	(uncompressed)

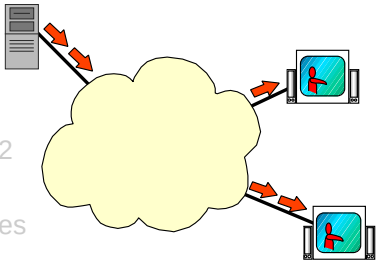
MPEG-2 TV Decoder



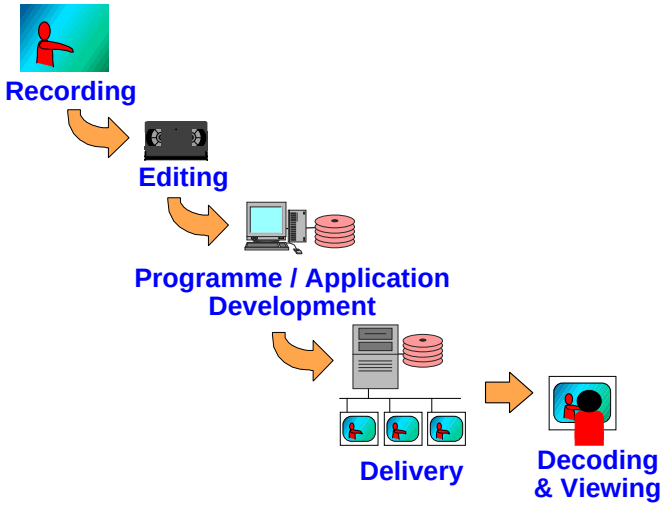
Antenna
UHF
Satellite
Cable Interface

Set Top Box (STB)
decodes video
decodes audio
conditional access
programme guide
other services

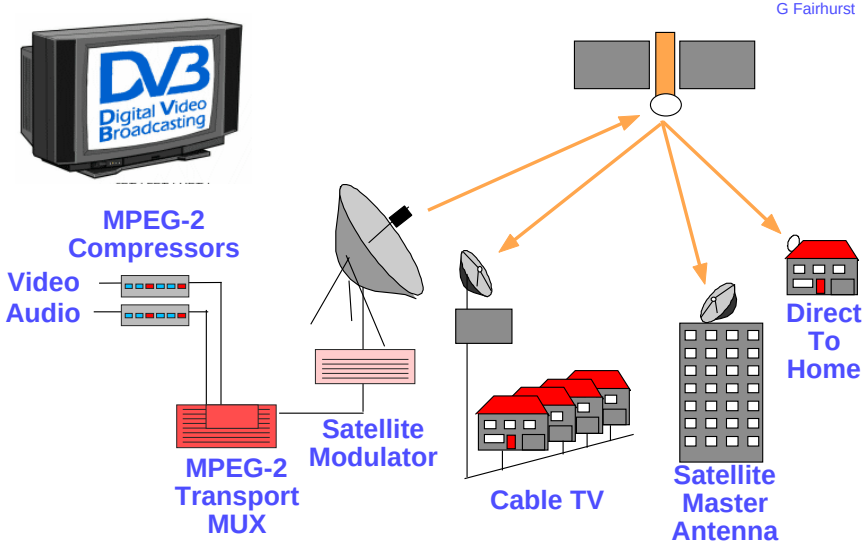
Set Top Box (STB)
4:3
16:9
High Definition



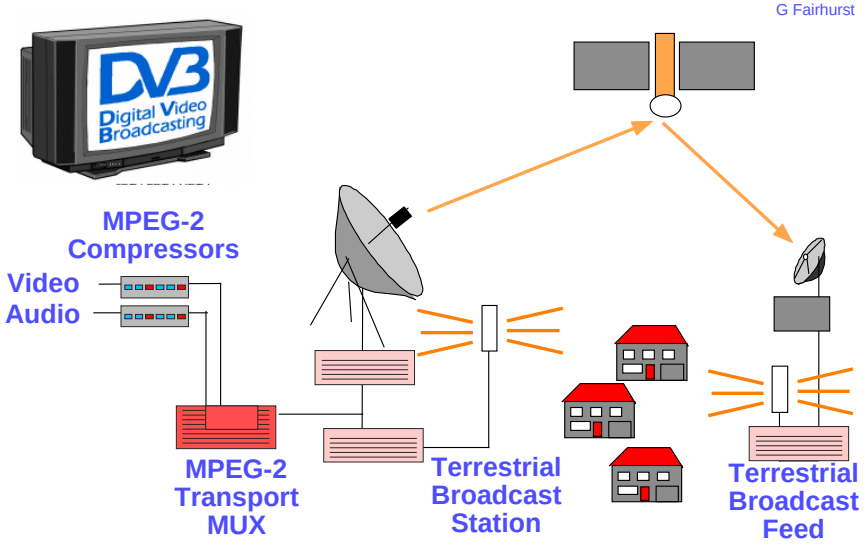
Production of MPEG-2 Programmes



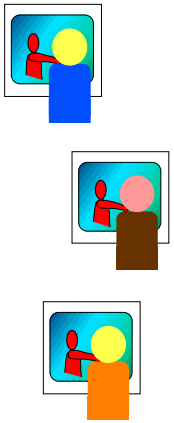
Digital Video Broadcasting



Digital Video Broadcasting



MPEG-2 Applications



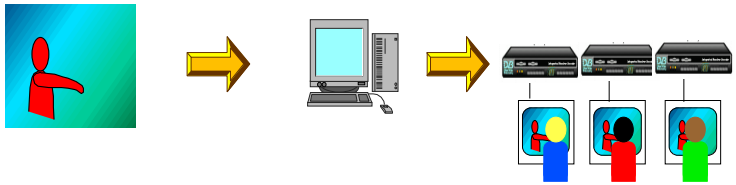
TV:

- **Traditional TV**
- **Narrowcast TV**
- **Video-on-Demand (VoD)**
- **Interactive TV**
- **3-D TV**
- **...**

Computers:

- **Video Clip Libraries**
- **Computer Aided Learning (CAL)**
- **Internet Transport Service**
- **...**

Progress to date



The MPEG-2 standard is accepted world-wide

It defines the functions of an encoder
but allows freedom in design of the decoder

MPEG-2 allows extensions for specific applications
(e.g. Interactive TV, Encryption, Programme Guides)

Over 200 companies now produce standard MPEG-2
components for digital TV

Finally ...

The future of TV is digital
The future is MPEG-2

The questions are:

- ***What can we do with MPEG-2?***
- ***How do we deliver MPEG-2 across the net?***