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DIGITAL TV BROADCASTING

How video and audio are encoded and transmitted in digital television

Information and encoding

- Bruno Gomes - 103320
- Diogo Silva - 104341



INTRODUCTION

- What is digital TV Broadcasting?
- How does it differ from analog broadcasting?
- What are the main advantages of digital TV broadcasting?
- What types of digital broadcasting exist?

DIGITAL VIDEO AND AUDIO ENCONDING BASICS

- Why is compression necessary?
 - Raw video and audio files are massive and DTV bandwidth is limited;
- Main video codecs:
 - MPEG-2: Widely used in older digital broadcasts;
 - MPEG-4: Common in modern broadcasts for better efficiency and quality;
 - HEVC: Used in more recent, high-definition transmissions.
- Main audio codecs:
 - AC-3: Commonly used in digital TV for surround sound;
 - AAC: Popular for digital audio broadcasting, which offers better quality at lower bit rates compared to older codecs.



DIGITAL VIDEO AND AUDIO ENCONDING BASICS

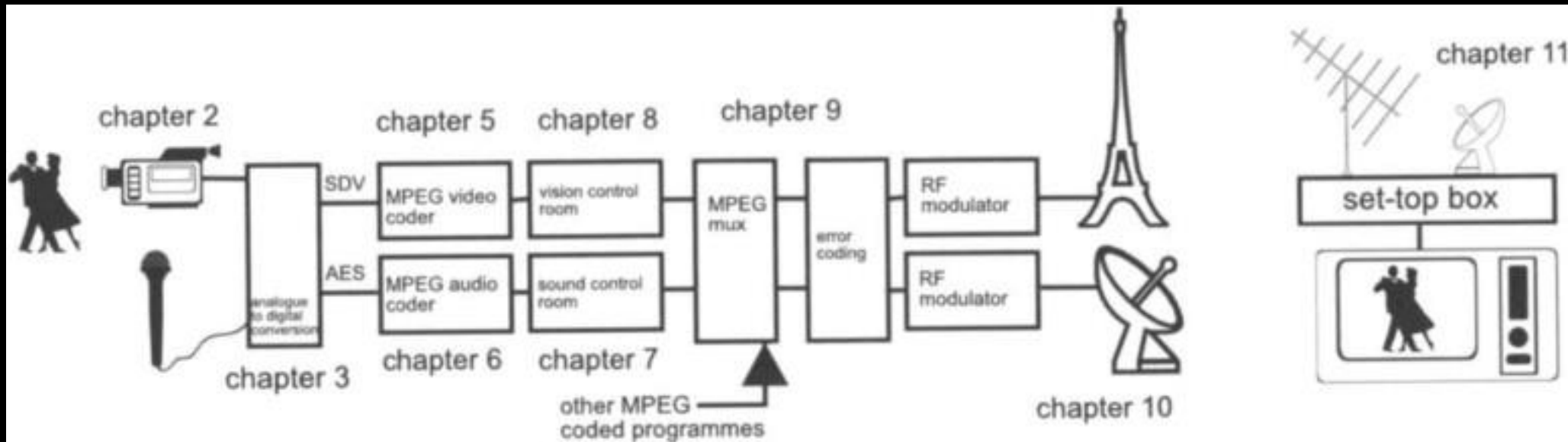


Fig.1 : Audio and video codecs

MPEG-4(H.264) AND HEVC(H.265)

- The functioning principle of both codecs is very similar, it focus mainly on the changing blocks of each frame.



Fig.2 : Image transmission example

MPEG-4(H.264) AND HEVC(H.265)

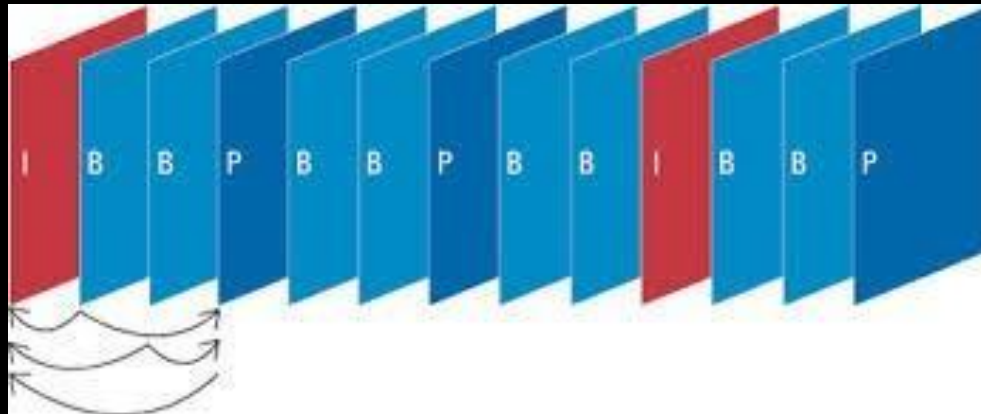


Fig.3 : Sequence of frames,I ,B and P

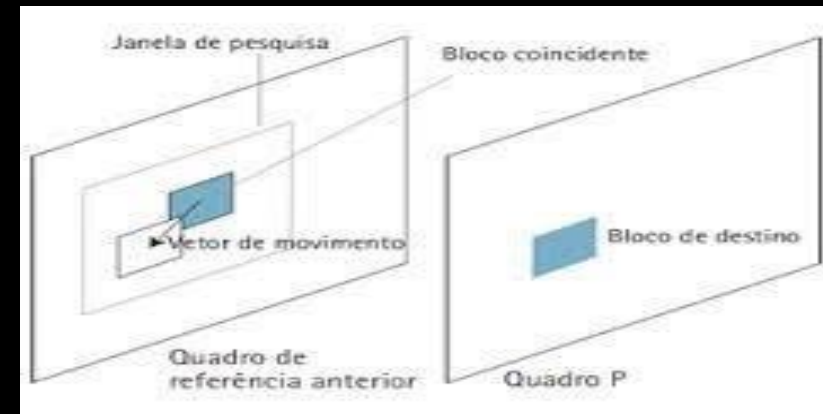


Fig.4 : Movement vector

HVEC(H.265) EVOLUTIONS



H.264/AVC



H.265/HEVC

Fig.5 : Block differences between H.264 and H.265

HVEC(H.265) EVOLUTIONS

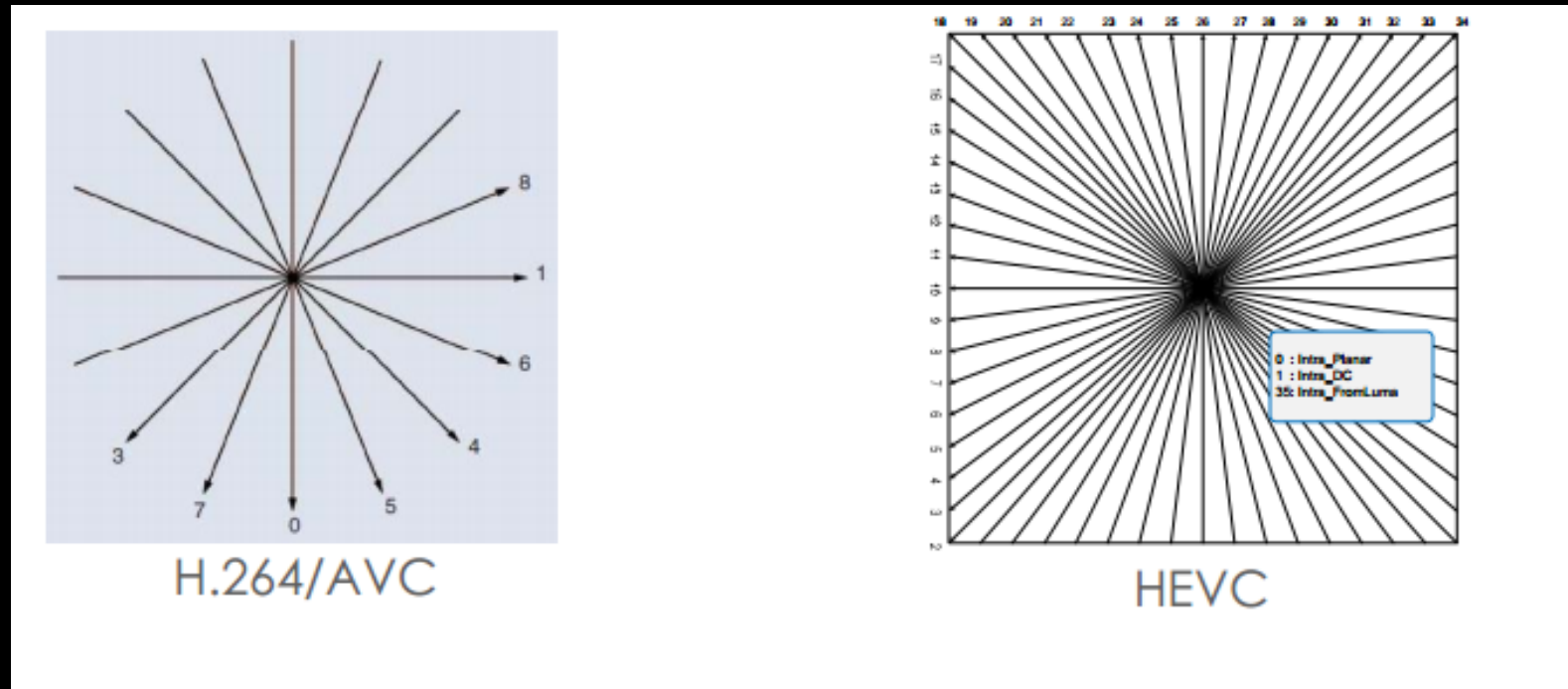


Fig.6 : Motion Vector differences

BANDWIDTH REQUIREMENTS

H.264 vs. H.265: Average bandwidth required per resolution

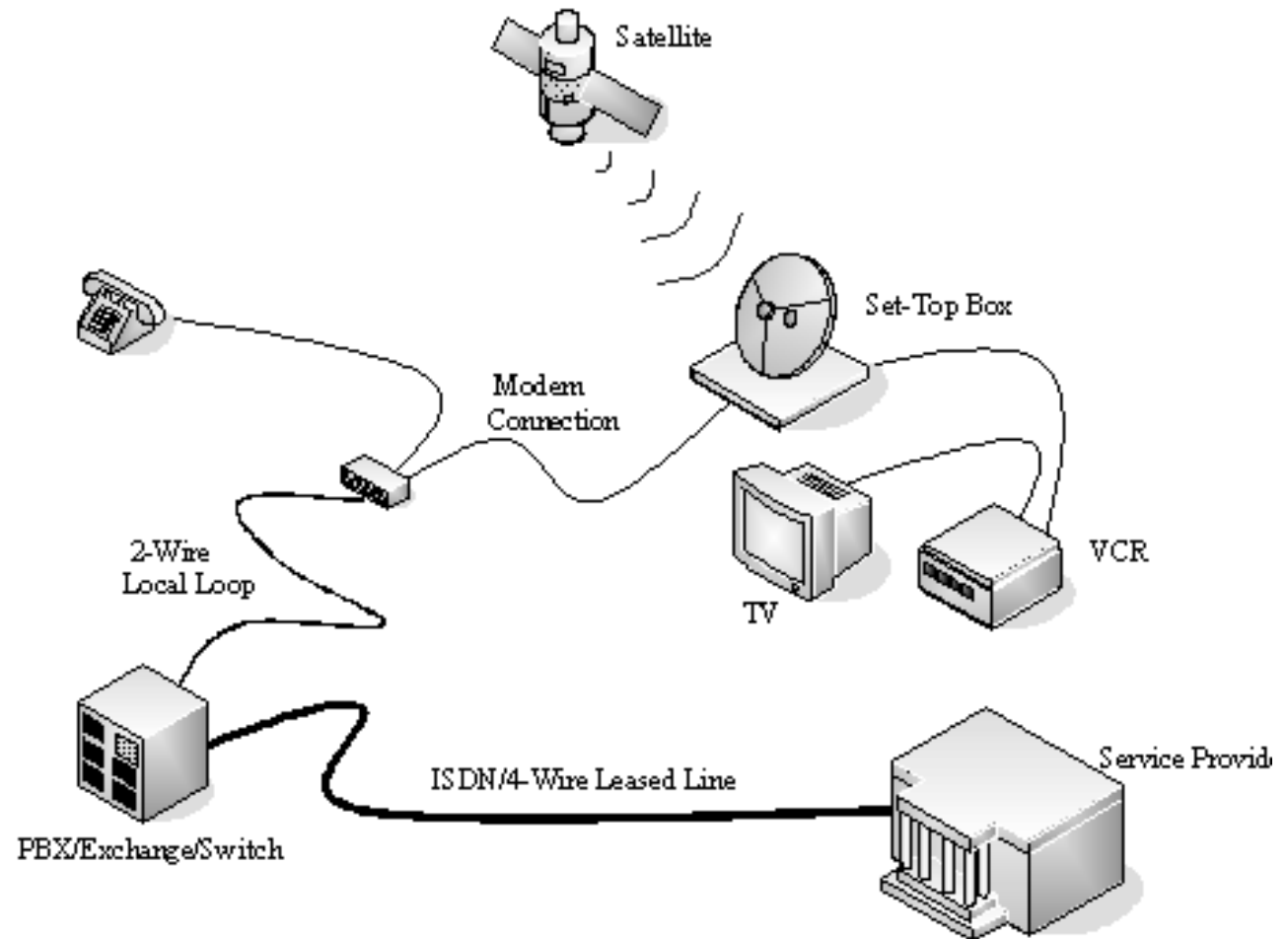
Resolution	H.264/AVC Bandwidth required	H.265/HEVC Bandwidth required
480p	1.5 Mbps	0.75 Mbps
720p	3 Mbps	1.5 Mbps
1080p	6 Mbps	3 Mbps
4K	32 Mbps	15 Mbps

AUDIO CODECS IN DIGITAL TV: AC-3 AND AAC

	AAC	AC3
Sample Rate	8 to 192 kHz	32, 44.1, 48 kHz
Bitrate	8-529 kbit/s (stereo)	32-640 kbit/s
VBR (Variable Bit Rate)	yes	no
Applications	Windows, macOS, Linux, Palm OS, Unix, Symbian OS, iOS, Android, Rockbox, Chromium, Digital TV service, Internet streaming, Digital Radio	Windows, Linux, iOS, movie theaters, TV broadcast, digital video streaming, DVDs, Blu-ray, radio broadcast, and gaming consoles

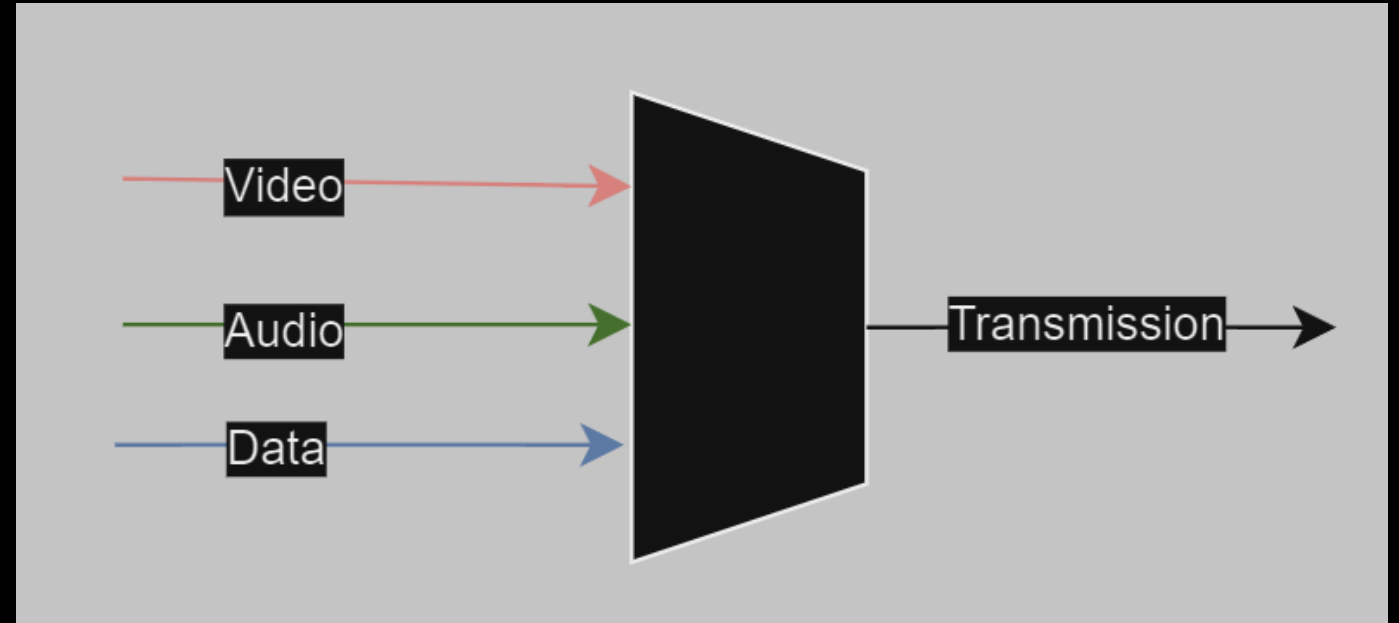
RECEPTION AND DECODING ON CONSUMER DEVICES

1. Digital Set-Top Box Overview:
 - Receives signals from satellite or cable;
 - Locks onto specific frequency and captures signals.
2. Decoding process:
 - Extract multiplexed transport streams;
 - Decoding audio and video;
 - Reconstruction.
3. Output for viewing:
 - Decoded video and audio are rendered together.



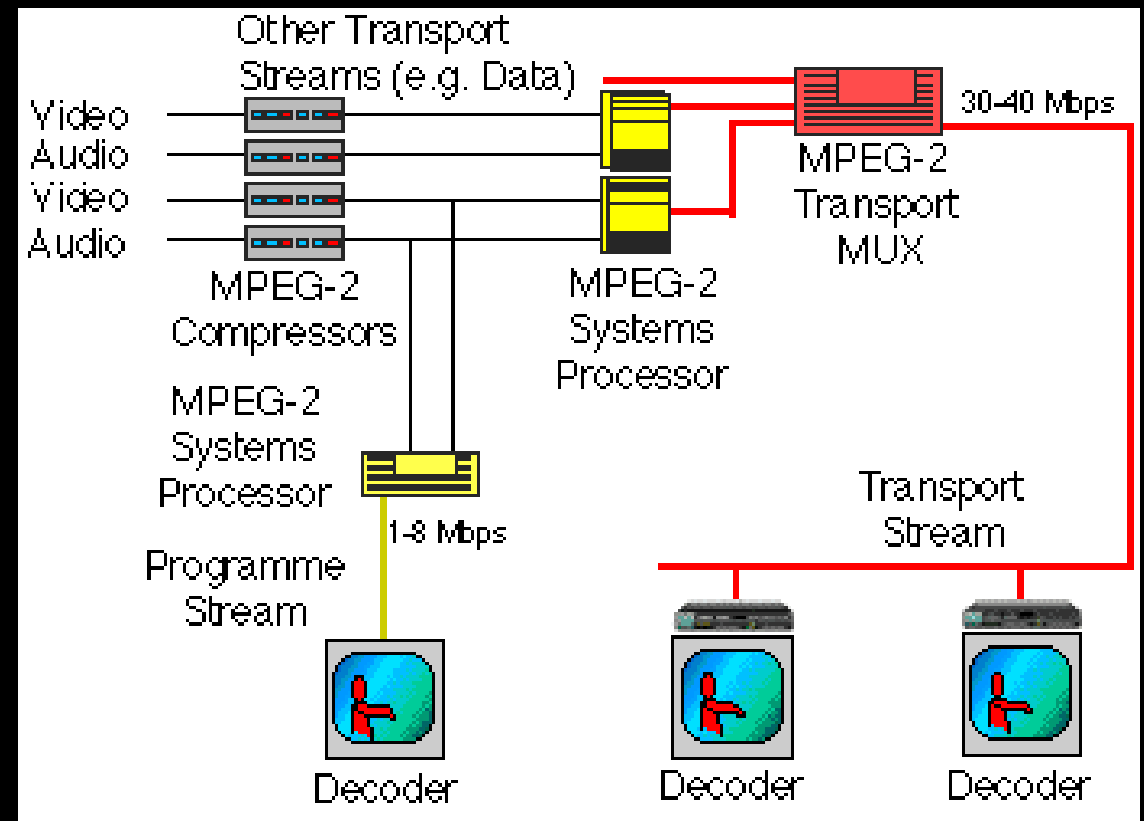
MULTIPLEXING AND CHANNEL ORGANIZATION

- Multiplexing is the process of combining multiple audio, video, and data streams into a single stream for broadcast



TRANSPORT STREAM

- MPEG-2 Transport Stream



PROGRAM-SPECIFIC INFORMATION (PSI)

- PAT (Program Association Table)
- PMT (Program Mapping Table)

MPEG Program Tables

(PAT) Program Association Table table_id = 0x00 ... transport_stream_id = 0x0AA1 ...	
Program Number	PMT PID
0x00F1	0x0100
0x00C2	0x0440
0x00B3	0x0301

This table identifies all of the available programs in a DTV station's MPEG data stream.

Program Number 0x00B3	
Stream Type	PID
PCR	0x0303
Video	0x0303
Audio	0x0206

The map table for this program number identifies the video, audio, and clock packets that make up this specific program.

DIGITAL TELEVISION BROADCAST STANDARDS

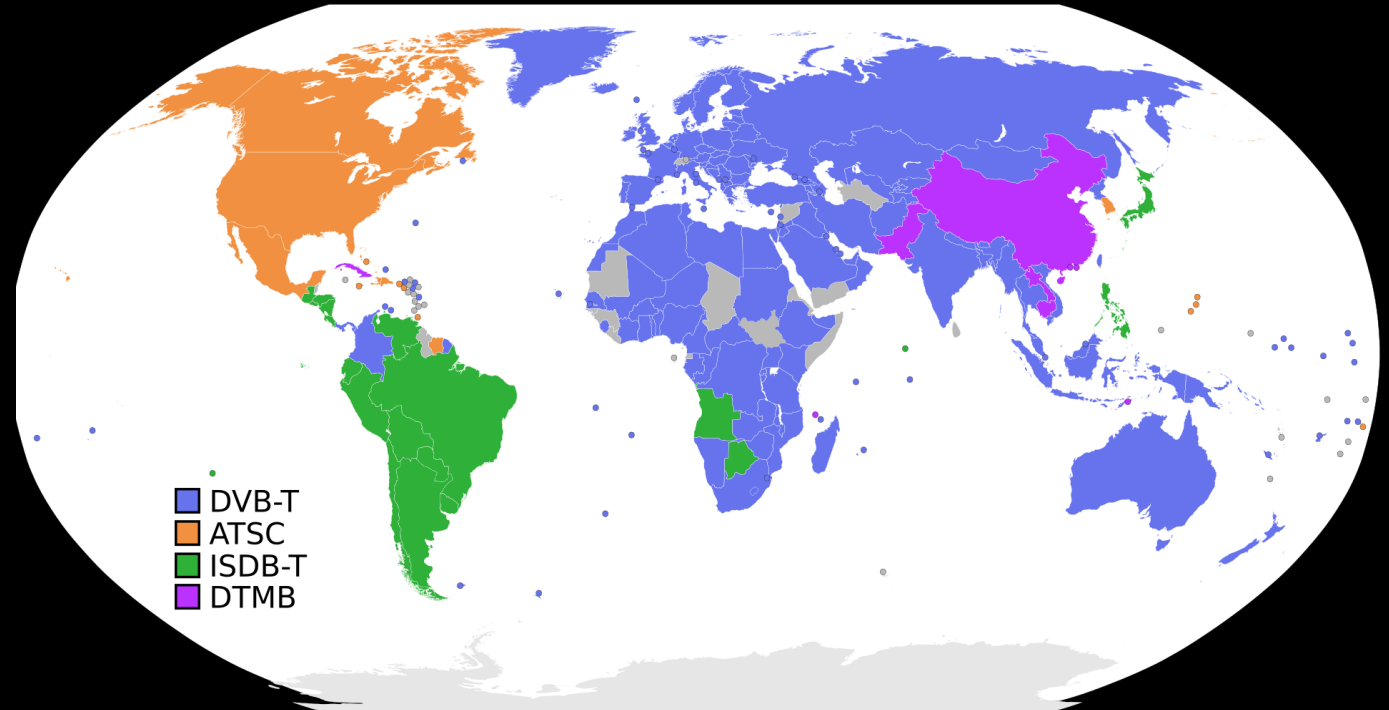
DVB

- DVB-T/T2
- DVB-C/C2
- DVB-S

ATSC

ISDB

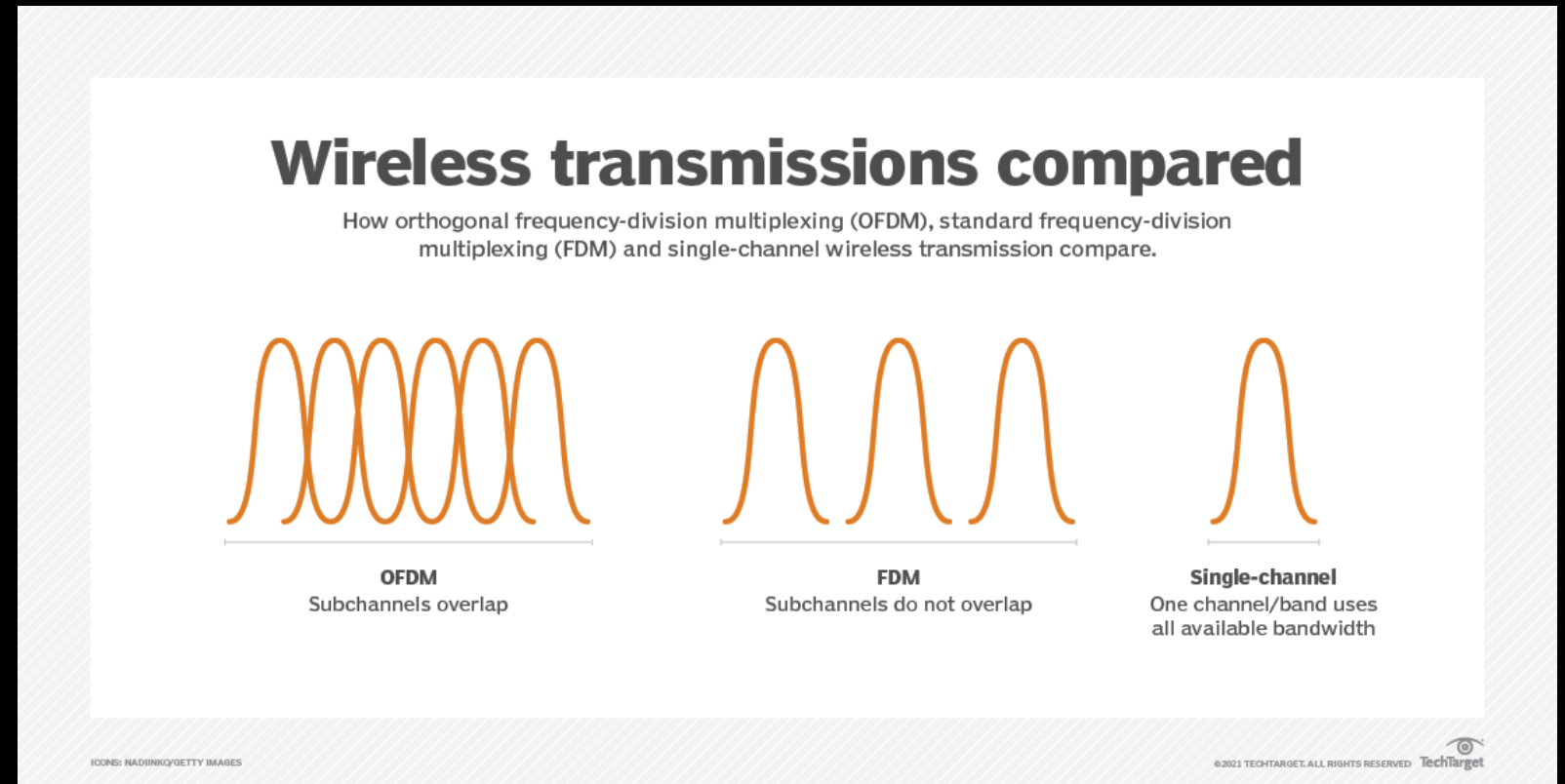
DTMB



TRANSMISSION PROCESS IN DIGITAL BROADCASTING

MODULATION

- DVB-T/T2: OFDM
- ATSC: 8-VSB

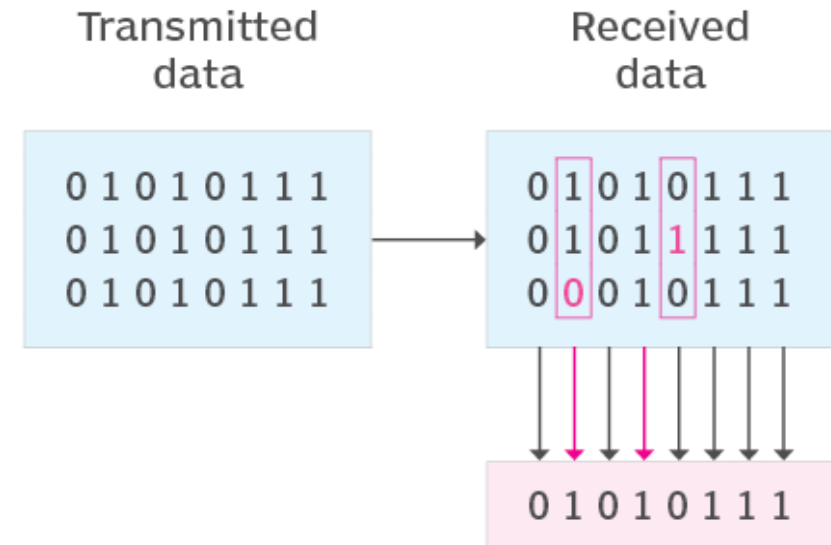


TRANSMISSION PROCESS IN DIGITAL BROADCASTING

ERROR CORRECTION

- FEC (Forward Error Correction)

How forward error correction works



TRANSMISSION PROCESS IN DIGITAL BROADCASTING

SIGNAL TRANSMISSION



- Terrestrial
- Satellite
- Cable

FUTURE TRENDS AND DEVELOPMENTS IN DIGITAL TV BROADCASTING

- EMERGING STANDARDS
- IPTV
- OTT

DVB-I®

ATSC 3.0

hulu

NETFLIX



THE END



QUESTIONS