Transition to the digital TV And technical aspects

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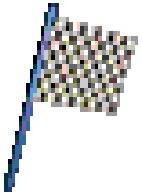
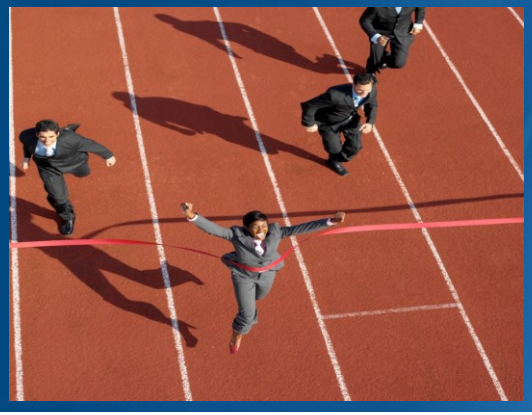


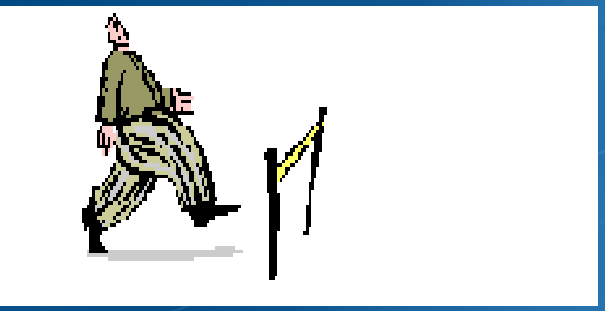
End of Transition

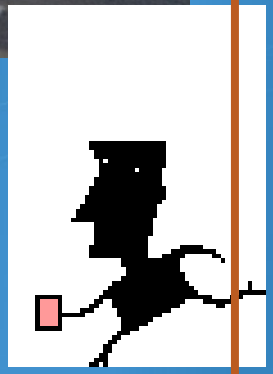
1

2

3







Transition accomplished

Transition going-on

Start of Transition

2nd Generation
3d,4th..???

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Overview

- Basic definitions : ASO, DSO, Simulcast…
- Why changing? (advantages and disadvantages)
- ASO/DSO models
- Planning ASO/DSO
- Existing DTT Standards tables
- Planning criteria

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Basic Definitions

- **ASO:** Analogue Switch-Off: Stop broadcasting in analogue Mode
- **DSO:** Digital Switch-Over: Migration process from analogue to digital broadcasting
- **Simulcast**: Broadcast simultaneously of analogue and digital
- **Transition** deadlines for Members part of GE06 Agreement:
  - 2015
  - 2020

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Why changing?

- Any choice? Really?
- Advantages of going Digital:
  - New possibilities to the viewers:
    - Additional number of programs
    - Reduction of transmission costs (Sharing infrastructure)
    - Additional reception modes: portable and mobile reception
    - Improve quality of image and sound including HDTV
    - Additional type of services: interactivity, Electronic Program Guides, etc.
  - For regulators:
    - Fair competition: To develop a terrestrial platform competitive with cable and satellite platforms
    - To be in line with GE06 Plan (as from 2015 no protection of analogue TV)
    - **Efficient use of spectrum**
- Disadvantages: New and big costs, new planning work, new

ASO/DSO Models

- Simulcast: broadcasting analogue and Digital
  - Everybody still can watch terrestrial TV
  - Frequency resource double used
- National shut-off of analogue services:
  - Clear and optimized use of frequencies
  - Risk of non covered regions or viewers not ready

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Planning the ASO/DSO: Regulatory aspect

- **Establish legislative framework**
  - Define ASO/DSO strategy (Implementation and timelines)
  - Ensure that the coverage is not less than the analogue one
  - Define areas for coverage
  - Licenses strategy :free-to-air or/and pay-tv services
  - Create a funding, if needed and if possible, to ensure sufficient financial structure
  - To ensure adequate digital receivers (Set top boxes) are in market at a reasonable price.
  - Ensure a good communication campaign to inform the Viewers and deploy means to assist (Web site, TV and Radio spots…)

Planning the ASO/DSO : Technical considerations

- Frequency Plan situation : Analyze the compatibility internal and with neighboring countries, coverage calculation (MFN/SFN), and take into account the Digital Dividend
  - If needed, modify (update) the national frequency assignment Plan, or GE06 Plan if Region 1
  - Notify to MIFR
  - If simulcast, ensure compatibility between digital and analogue
- Analogue transmitters to be replaced with digital equipment
- Analyze DTT Standards (modulation scheme, bite rate, guard interval, compression coding, HDTV, SDTV, etc.) to ensure the best reception conditions

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DTT System standards

- **DVB**:
  - DVB-T : Digital Video Broadcasting Terrestrial (System B)
  - DVB-H: Digital Video Broadcasting Handheld
  - DVB-T2 : Second Generation of DVB-T
    - At least 30% higher transmission capacity and improved SFN performance
- **ASTC**: Advanced Television Systems Committee (System A)
  - ATSC-M/H- Advanced Television Systems Committee Mobile & Handheld.
- **ISDB-T**: Integrated Services Digital Broadcasting Terrestrial- (System C)
  - SBTVD: Adapted by Brazil
- **DMB-T/H** (ChinaDTV): Framing structure, channel coding and modulation for DTTB system: designed for fixed and mobile reception.
- **T-DMB:** Terrestrial Digital Multimedia Broadcasting system: enables

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Description of Digital Television Broadcasting systems

Standard	Channels	Band	Modulation	Applicable standards
ATSC	6 MHz	UHF/VHF	8-VSB	A/52,A/53, A/65, A/153
ChinaDTV DMB-T	8 MHz	UHF/VHF	OFDM	GB 20600-2006
DVB-T	6, 7 and 8 MHz	UHF/VHF	OFDM	EN 300 744
DVB-H	5, 6, 7 and 8 MHz	UHF/VHF	OFDM	EN 302 304
ISDB-T	6, 7 and 8 MHz	UHF/VHF	Segmented OFDM	ARIB STD-B31

Mobile digital broadcasting

Standard or Spec.	Modulation	Transport stream	RF channel (MUX) size (MHz)	Int. Broadcast bands	Regional national origin
DVB-H	QPSK or 16-QAM COFDM	IP/MPE-FEC/ MPEG2 TS	8	IV and V	Region 1 (Europe)
ISDB-T	QPSK or 16-QAM COFDM	MPEG2 TS	0.433	IV and V	Region 3 (Japan)
T-DMB*	DQPSK COFDM	MPEG2 TS	1.75	III and 1.5 GHz	Region 3 (Rep. of Korea)
T2-lite	QPSK	H.264	8	IV and V	Region 1 (Europe)

*: Fully compatible with T-DAB

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DVB-T 2 DVB-T2?

	DVB-T	DVB-T2
FEC (forward Error Correction)	Convolutional Coding + Reed Solomon 1/2, 2/3, 3/4, 5/6,7/8	LPDC+BCH 1/2 ,3/5, 2/3,3/4, 4/5, 5/6
Modes	QPSK, 16QAM, 64QAM	QPSK, 16QAM, 64QAM, 256QAM
Guard interval	1/4, 1/8, 1/16, 1/32	1/4, 19/256, 1/8, 19/128, 1/16, 1/32, 1/128
FFT size	2k, 8k	1k, 2k, 4k, 6k, 8k, 16k, 32k

DTT Compression coding

- MPEG2/H.262: 4-6 programs SDTV in 1 channel 8Mhz
- MPEG4 AVC/H.264:
  - 6-10 SDTV programs in 1 channel,
  - 4-6 HDTV programs in 1 channel
- H.265 High Efficiency Video Coding (HEVC):
  - double the data compression ratio compared to H.264,
  - can support 8K UHD

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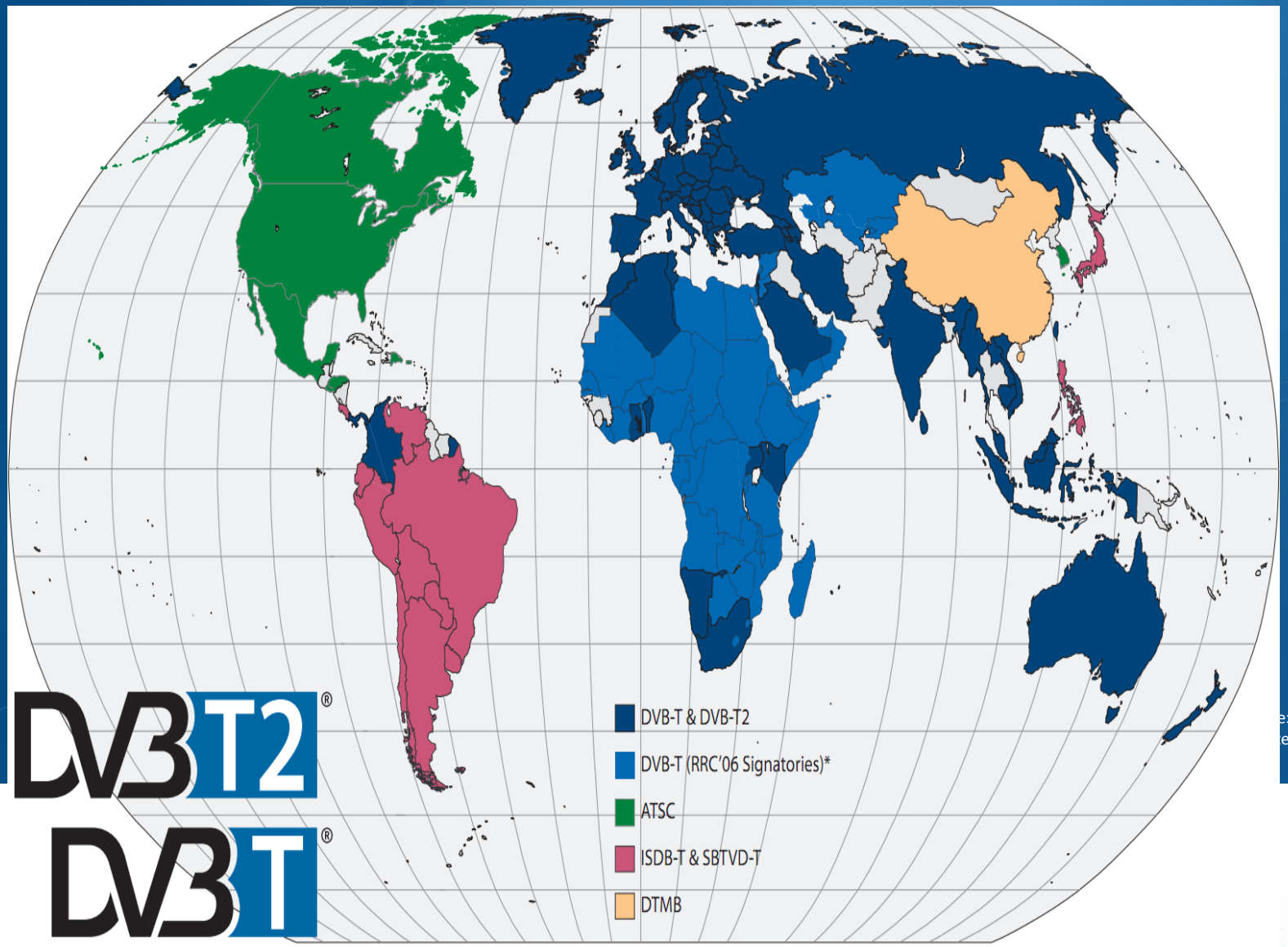
TV standards in the World



DVB T2®

DVB T®

e: DVB
e: January 2011

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cation

Modulation type features

- QPSK, QAM 16,64,256: phase/amplitude constellations.
- The choice of constellation determines :
  - the number of bits that are carried at a time on each sub-carrier:2 bits (QPSK), 4 bits (16-QAM) or 6 bits (64-QAM).
  - noise tolerance, with QPSK being around 4 to 5 times more tolerant than 64-QAM

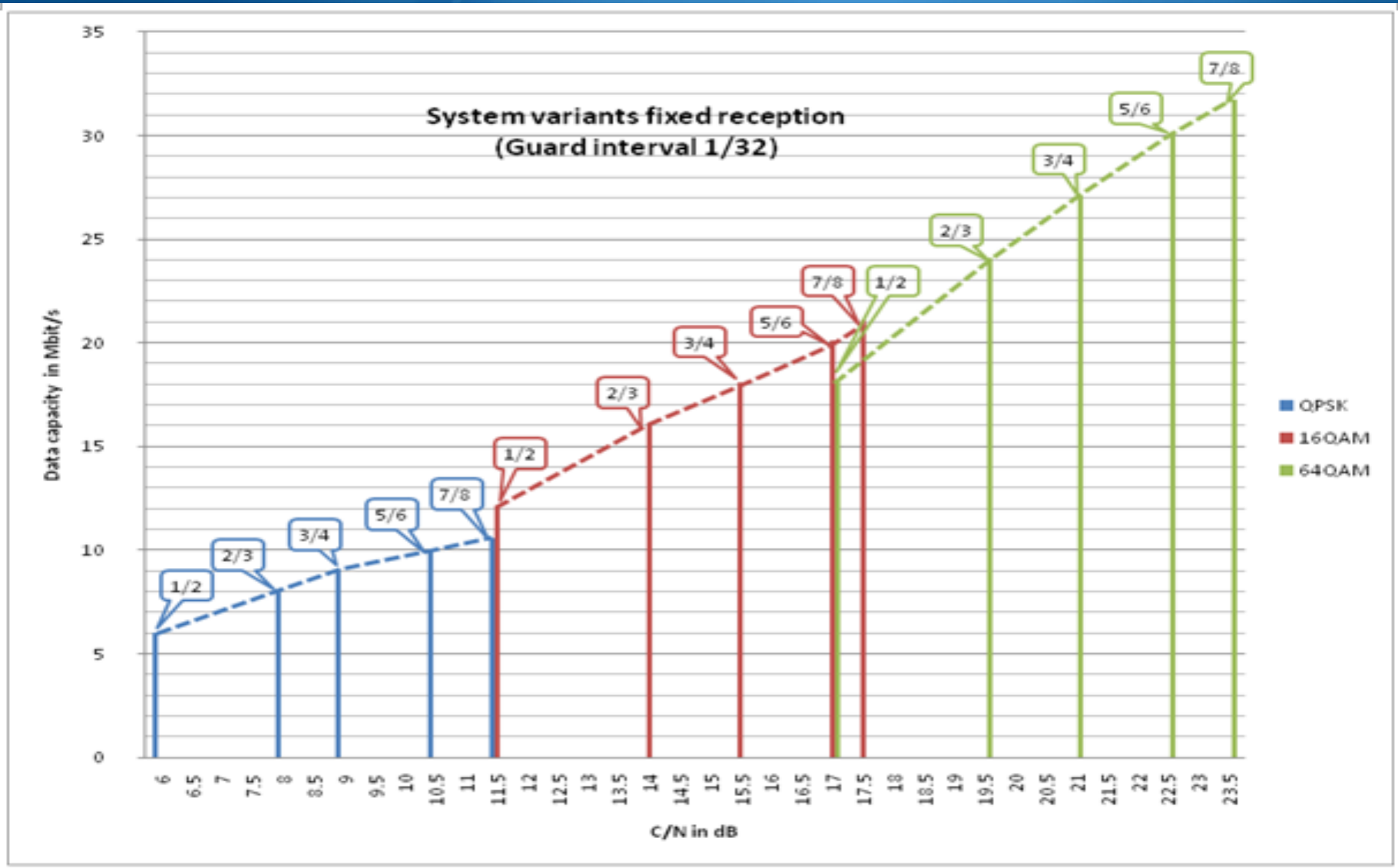
	Capacity	**Ruggness**	**Area**
QPSK	low data	Very	Urban
16-QAM	Moderate	Reasonable	Medium/dense
64-QAM	High	Low	Large area

Code rates

- Code rate:1/2, 2/3, 3/4, 5/6, 7/8
- Used to trade bit rate versus ruggedness, e.g. the signal strength required and interference protection required.

	Transmission safety/redundancy	**Advantage/disadv.**
1/2	High	**Used in channels with high degree of interference (ex. Mobile implementation)**
3/4	Not high	**Offers additional capacity**
5/6	Low	**Implementation margin very high (not very realistic)**
7/8	Very low	**Implementation margin very high (not very realistic)** **High throughput→** **Used in channels with low level f interference**

System variants



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Technical features FFT

(Fast Fourier Transform)

- The DVB-T standard defines two FFT modes to constitute the OFDM signal:
  - **2K**
  - **8K**

	Number of sub-carriers	Usable symbol time Tu (µs)	Area	Application
2k	2048	224	Small SFN area	Mobile
8k	8192	896	Large SFN Area	Fixed

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Technical parameters

Bit rates/Guard intervals

The guard interval is a proportion of the time there is no data transmitted between the symbols.

		1/32	1/16	1/8	1/4
2k	Duration of useful symbol (μs)	7	14	28	56
	Distances (km)	2.1	4.2	8.4	16.8
8k	Duration of useful symbol (μs)	28	56	112	224
	Distances (km)	8.4	16.8	33.6	67.2

Example:

- For an 8K-FFT system, and guard interval of 1/4
- → **it means that the permissible signal delay times are outside the signal delay between adjacent transmitters, when these transmitters are situated more than 67.2 km apart.**

Compromises??

- The guard interval reduces the amount of time available for data transmission→Lengthening the GI decreases the bit rate.
- The more robust the variant is, the less data can be transported, but the larger the SFN can be, examples:
  - In Germany a rather robust variant was chosen with a large guard interval (16-QAM 2/3 guard interval 1/4) in order to allow for SFNs.
  - In France, a variant of high capacity with a small guard interval (64 – QAM 2/3 Guard Interval 1/32) was chosen.

Example: DTT multiplex use in France

Multiplex	Modulation	GI	FEC rate	FFT	Capacity (Mbit/s)	Content	Compression
RI	64-QAM	1/32	2/3	8k	24.10	6 SDTV programmes	MPEG-2
R2	64-QAM	1/32	2/3	8k	24.10	6 SDTV programmes	MPEG-2
R3	64-QAM	1/32	2/3	8k	24.10	5 SDTV programmes, 1 HDTV programme	MPEG-4
R4	64-QAM	1/32	2/3	8k	24.10	4 SDTV programmes, 1 HDTV programme	Mixed MPEG-2 and MPEG-4
R5	64-QAM	1/32	2/3	8k	24.10	3 HDTV programmes	MPEG-4
R6	64-QAM	1/32	2/3	8k	24.10	7 SDTV programmes	Mixed MPEG-2 and MPEG-4

Number of programmes per multiplex for fixed reception with DVB-T 64-QAM-2/3-8K-GI 1/32 and DVB-T2-256-QAM-2/3-16K-GI 1/32

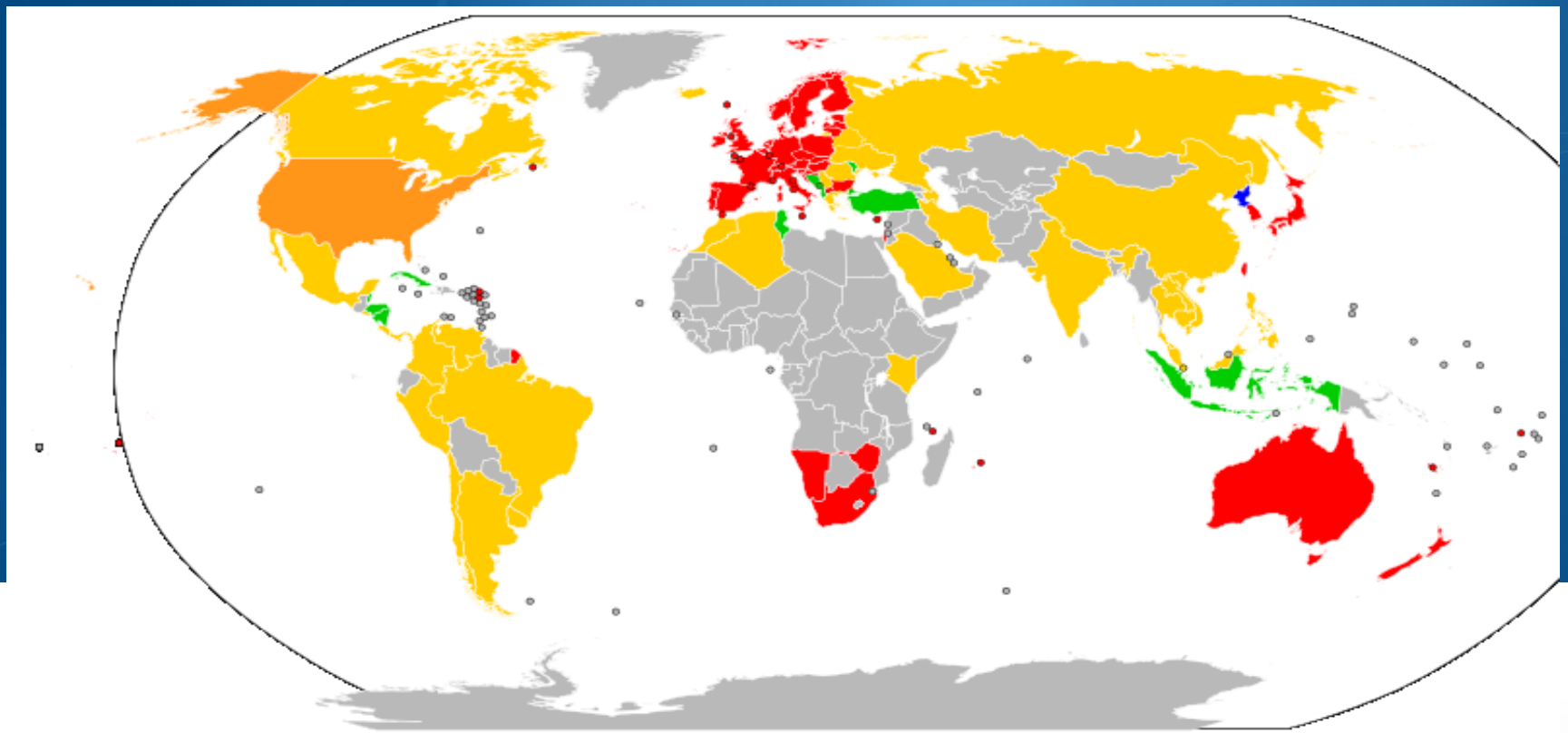
Format	Source coding	No of progs DVB-T	No of progs DVB-T2	No of progs DVB-T	No of progs DVB-T2
		Fixed MUXing		Fixed MUXing FUTURE	
SD	MPEG-2	6	10	6	10
SD	MPEG-4/AVC	9	13	10	15
HD-720p	MPEG-4/AVC	3	4	3	5
HD-1080i	MPEG-4/AVC	2	4	3	4
		Statistical MUXing		Statistical MUXing FUTURE	
SD	MPEG-2	8	13	8	13
SD	MPEG-4/AVC	11	16	13	19
HD-720p	MPEG-4/AVC	3	5	3	5
HD-1080i	MPEG-4/AVC	3	4	3	5

World map of digital television transition progress

Legend:

- *Transition completed, all analog signals terminated*
- *Transition completed for full power stations, not yet completed for low power stations*
- *Transition in progress, broadcasting both analog and digital signals*
- *Transition not yet started, broadcasting analog signals only*
- *Does not intend to transition, broadcasting analog signals only*
- *No information available*

Source: Wikepedia (2014)



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Thank you for your attention