

High Dynamic Range (HDR) in IP TV

introduction of HDR, opportunities and challenges

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Presentation Contents

- Introduction
- What is KPN iTV (and 4K on iTV)
- What would it take to start HDR service?
 - What flavour HDR?
 - Who can be reached?
 - High level Architecture
 - UHD Beyond HDR: High Frame Rate!

KPN

IP TV operator

- KPN is a Telco and IP TV operator
- 1.8 million TV customers
- 20% of Dutch TV market

- Over 200 channels linear TV, radio channels, Pay Per view channels.
- Network/cloud based services:
 - NPVR, Start over TV, replay TV
 - TV Apps including Netflix

KPN UHD services

- KPN has started small scale 4K TV service in 2016
- 1000 UHD STB's
 - Linear TV (2 channels)
 - Started July 2016 with UEFA Euro 2016 finals live in 4K
 - Video on demand with 4K video's
 - 4K Video in TV Apps

KPN UHD Set Top Box

- HDMI 2.0 upgradable to HDMI 2.0a and 2.0b
- Capabilities
 - 4K,
 - HDR-10,
 - HLG capable



What is happening

Recent developments

- UHD Forum
- ITU-R BT.2100
- HDMI v2.0b
- DVB Blue Book A157 (*TS 101 154*)
- 4K HDR ULTRA HD logo: logo for DVB Blue Book A157

UHD Forum Phase A

UHD Phase A Definition

Spatial Resolution	1080p* or 2160p
Color Gamut	BT.709, BT.2020
Bit Depth	10-bit
Dynamic Range	SDR, PQ, HLG
Frame Rate**	24, 25, 30, 50, 60
Video Codec	HEVC, Main 10, Level 5.1 (single lyr)
Audio Channels	Stereo or 5.1 multi-channel audio
Audio Codec	AC-3, EAC-3, HE-ACC, AAC-LC
Captions/Subs Coding (in/out formats)	CTA-608/708, ETSI 300 743, ETSI 300 472, SCTE-27, IMSC1



ITU-R BT.2100

Image parameter values for high dynamic range television

- PQ (Perceptual Quantization) and HDR10
- HLG (Hybrid Log-Gamma)
- simple conversion process between PQ and HLG.



HDMI

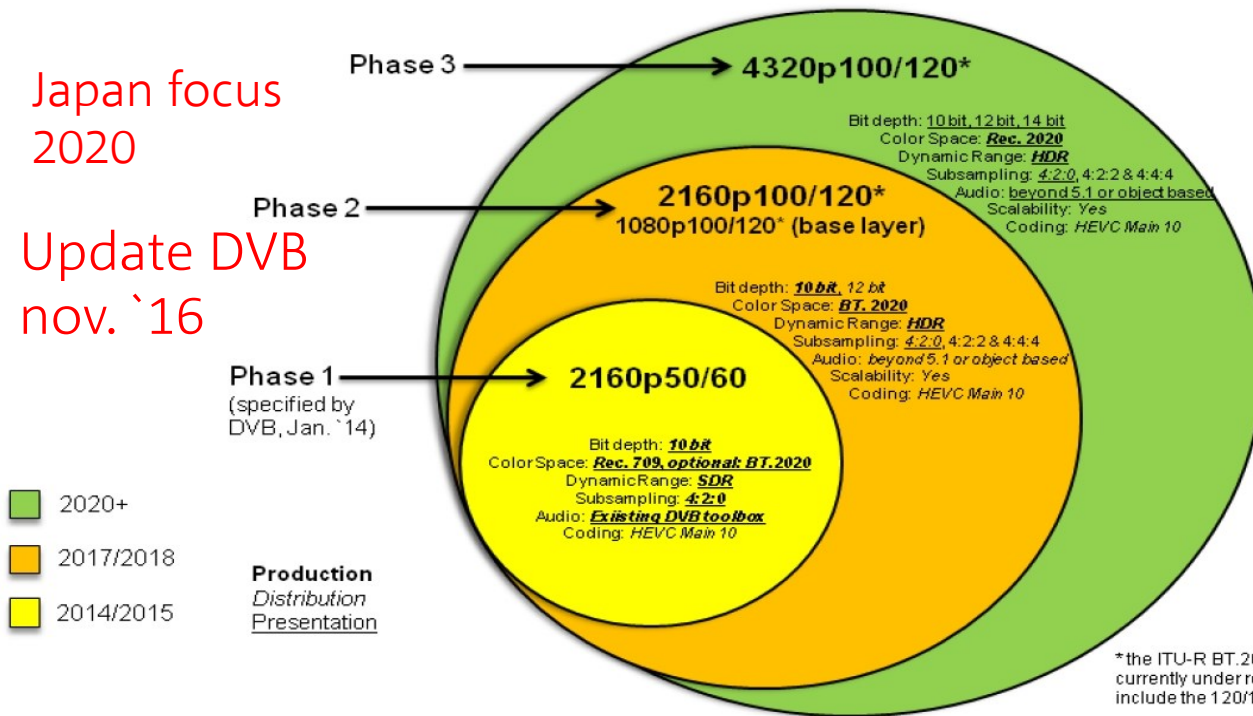
New 2.0b and 2.1 standards

- V 2.0 4K
- V 2.0a 4K and HDR-10
- V 2.0b 4K, HDR-10 and HLG
- V 2.1 4K, HDR-10 and HLG and HFR (120 frames/s)



DVB BlueBook A157 (ETSI TS 101 154)

Phase 2 specified in nov 2016 update of standard



*the ITU-R BT.2020 standard is currently under revision to also include the 120/1.001 and 100 fps.

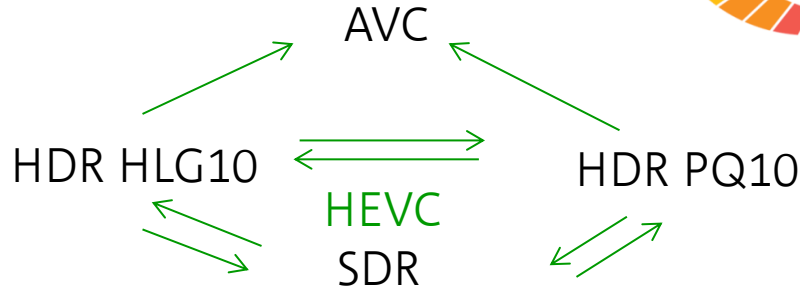
4K HDR ULTRA HD logo

2017 announced European logo

- 4K Resolution 3840 * 2160
- HDR (HDR10 and HLG)
- SDR
- Frame rate up to 50 fps
- HDMI 2.0b
- Seamless transitions:



Digital Testing



UHD TV sets in Netherlands

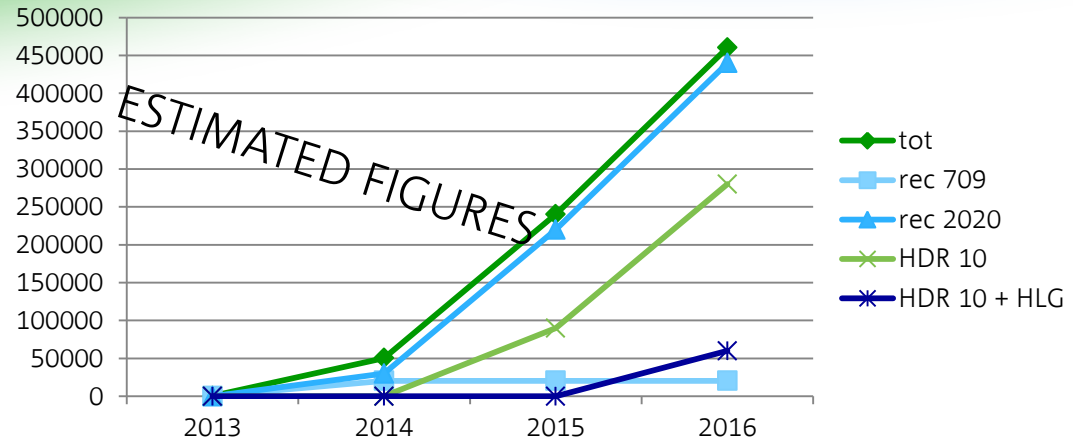
Rough estimates

2016:

30% of all sold new TV sets are UHD

This Figure is growing every month
with 3-4 %

- 2013 Introduction of 4K (rec 709)
- 2014 Introduction of 4K with rec 2020
- 2015 introduction of HDR 10
- 2016 introduction of HLG (and Dolby Vision)

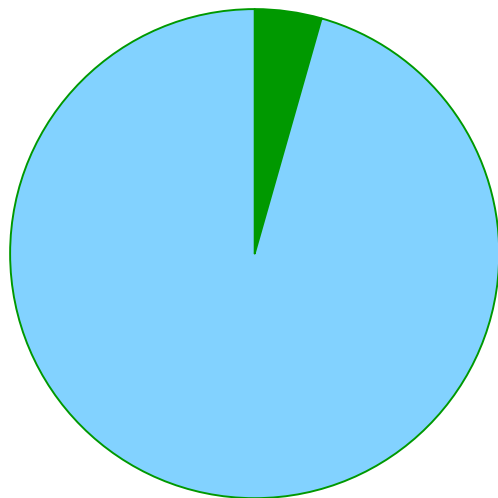


Install base UHD TV sets end 2016

Rough estimate colour space

(optimistic scenario)

2016 colour space



- rec 709
- rec 2020

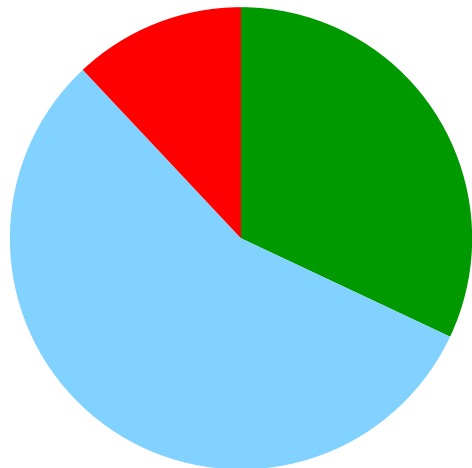
*Number of “rec 709 only TVs” is low.
All new TV support rec 2020*

Install base UHD TV sets end 2016

Rough estimates 4K only and HDR

(optimistic scenario)

2016 4K versus HDR



■ 4k only + rec
2020

■ HDR 10

■ HDR 10 + HLG

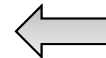
*Number of “4K only
TVs” is substantial.
4K TV are still being
sold today*

There are 6 types of UHDTV panels on the market

2014



HDMI 1.4, AVC
8 bit, Rec 709 color space

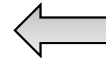


Only suitable for OTT UHDTV service, not via STB due to lack of HDCP 2.2

2014/
2015



HDMI 2.0, HDCP 2.2, AVC
8 bit, Rec 709 color space

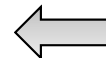


Can support KPN “4K-only” service

2015/
2016



HDMI 2.0, HDCP 2.2, HEVC
8/10 bit, **Rec 2020 color space**



Can support KPN “4K-only” service. And can interpret HLG signals.

2016



HDMI 2.0a, HDCP 2.2, HEVC
10 bit, Rec 2020 color space
HDR10



First HDR devices on the market. Will render HLG signals as SDR image

2016



HDMI 2.0a, HDCP 2.2, HEVC
10 bit, Rec 2020 color space
HDR10, **HLG**



Supports HLG, but needs upgrade to HDMI 2.0b. to support HLG signalling

2016



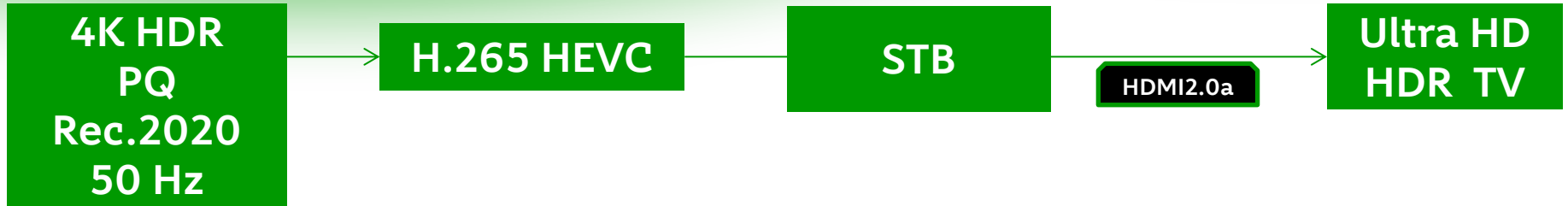
HDMI 2.0b, HDCP 2.2, HEVC
10 bit, Rec 2020 color space
HDR10, HLG, **Dolby Vision**

Thought Experiment: Start HDR service

Who will be able to see this service?

4K HDR
PQ
Rec.2020
50 Hz

4K HDR (using PQ)



PQ: 3 out of 6 UHD types

Covering 2/3 of the TV sets in the homes

2014



2014/
2015



2015/
2016



2016



HDR

2016



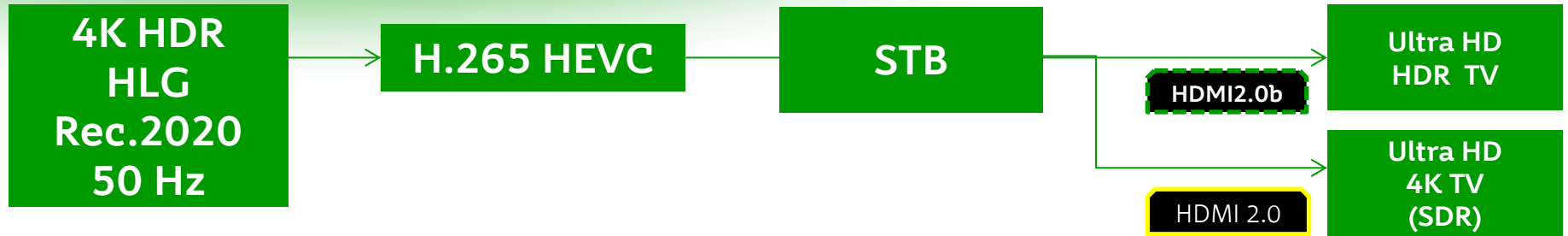
HDR

2016



HDR

4K HDR (using HLG)



HLG: 4 out of 6 UHD types

But 2 types in SDR only

2014



?

2014/
2015



?

2015/
2016



SDR

2016



SDR

2016



HDR

2016



HDR

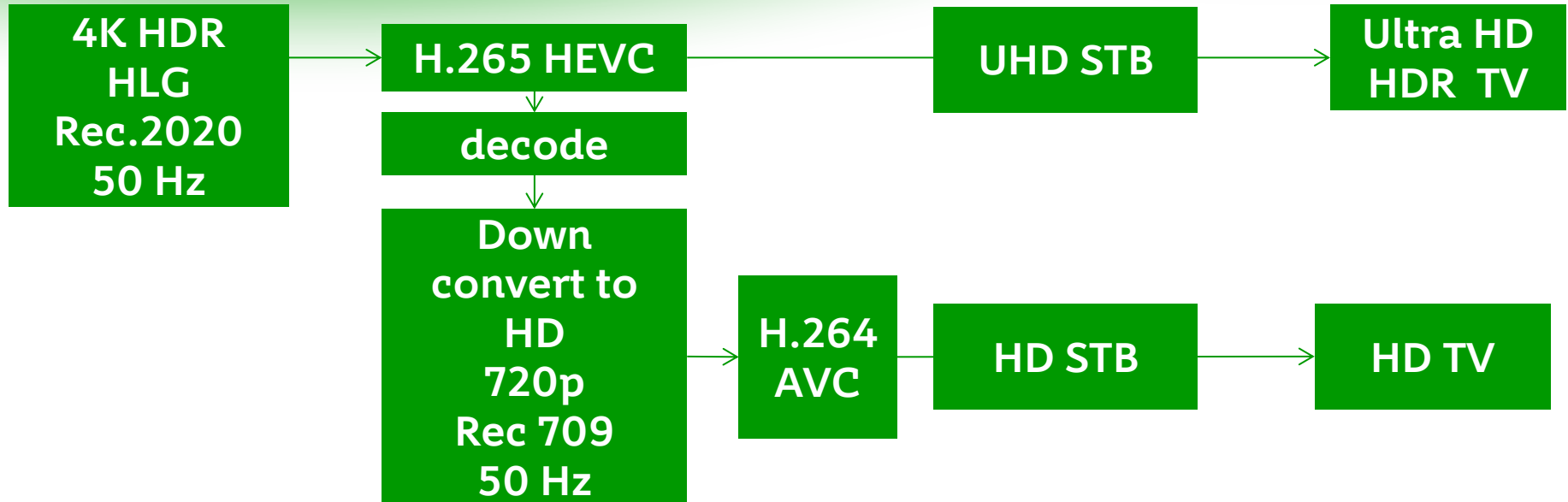
Simulcast

Introduce Safety Net for non HDR viewers

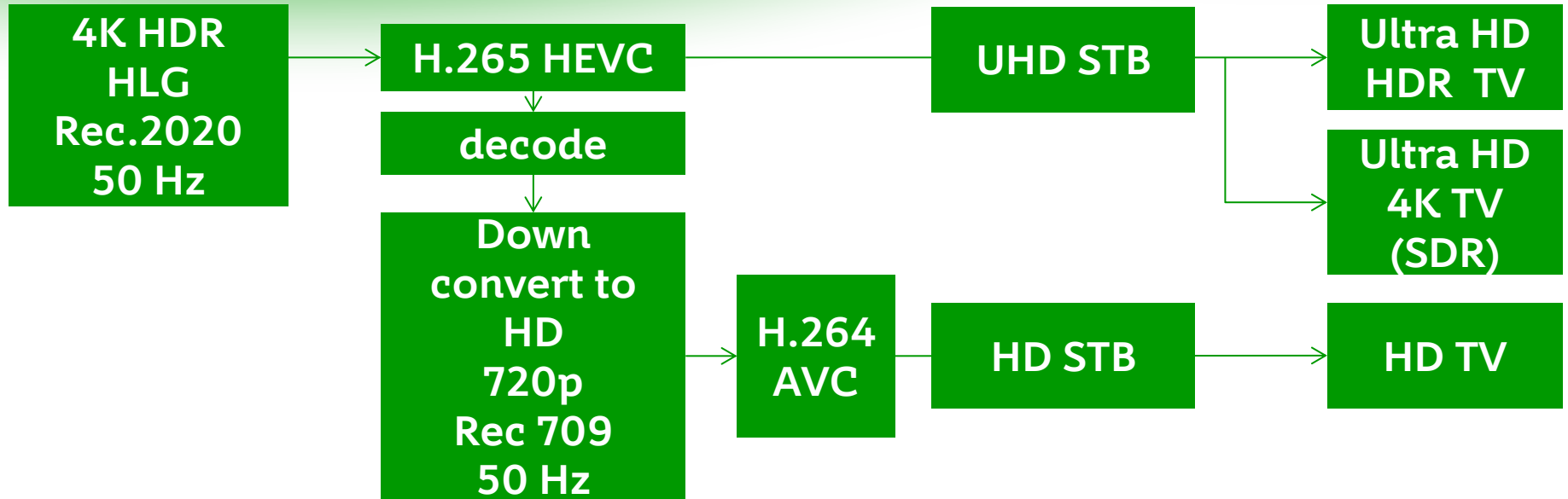
- Down convert HDR to SDR in head end.
- Transmit in simulcast: choose between
 - 4K
 - HD

HD seems the logical choice: Low bandwidth, Higher reach: all existing TV sets







Simulcast 4K HDR (using PQ) and HD



Simulcast 4K HDR (using HLG) and HD



Mapping of 4K PQ and HLG services on UHD TV's.

		PQ	HLG	PQ HD	HLG HD
2014			?	HD	HD
2014/ 2015			?	HD	HD
2015/ 2016			SDR	HD	SDR
2016		HDR	SDR	HDR	SDR
2016		HDR	HDR	HDR	HDR
2016		HDR	HDR	HDR	HDR

High Frame Rate

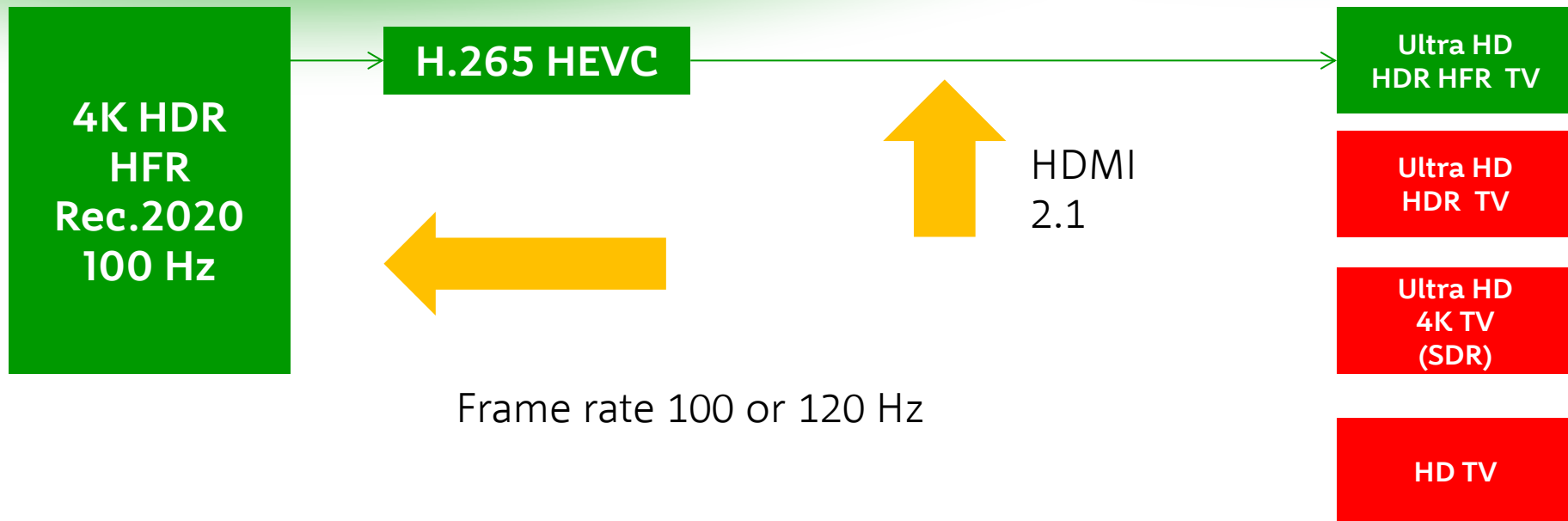
HDR HFR

DVB Blue Book A157 or ETSI TS 101 154

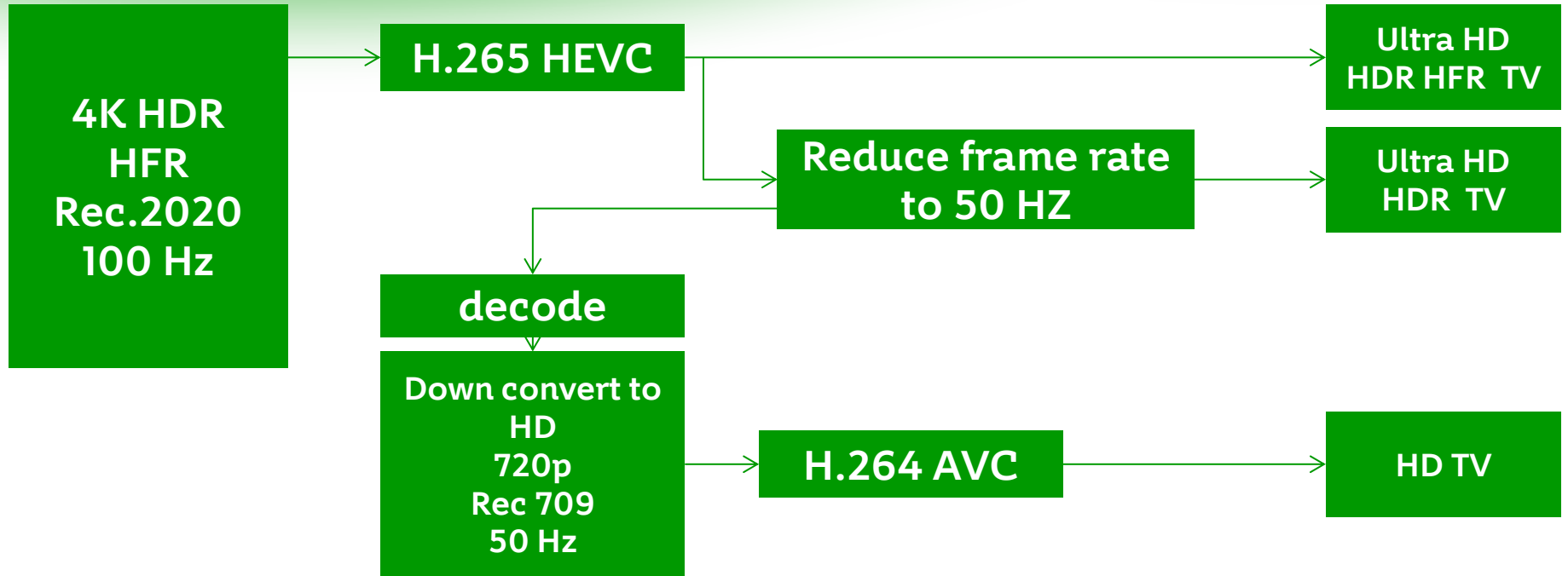
Released in November 2016 and came with a future option (2018-2019)

- High Frame Rate always in combination with HDR
- Frame rate up to 120 frames/s
- Two HEVC encoding options:
 - Non scalable
 - Dual video pid temporal scalable encoding (*backwards compatible!*)

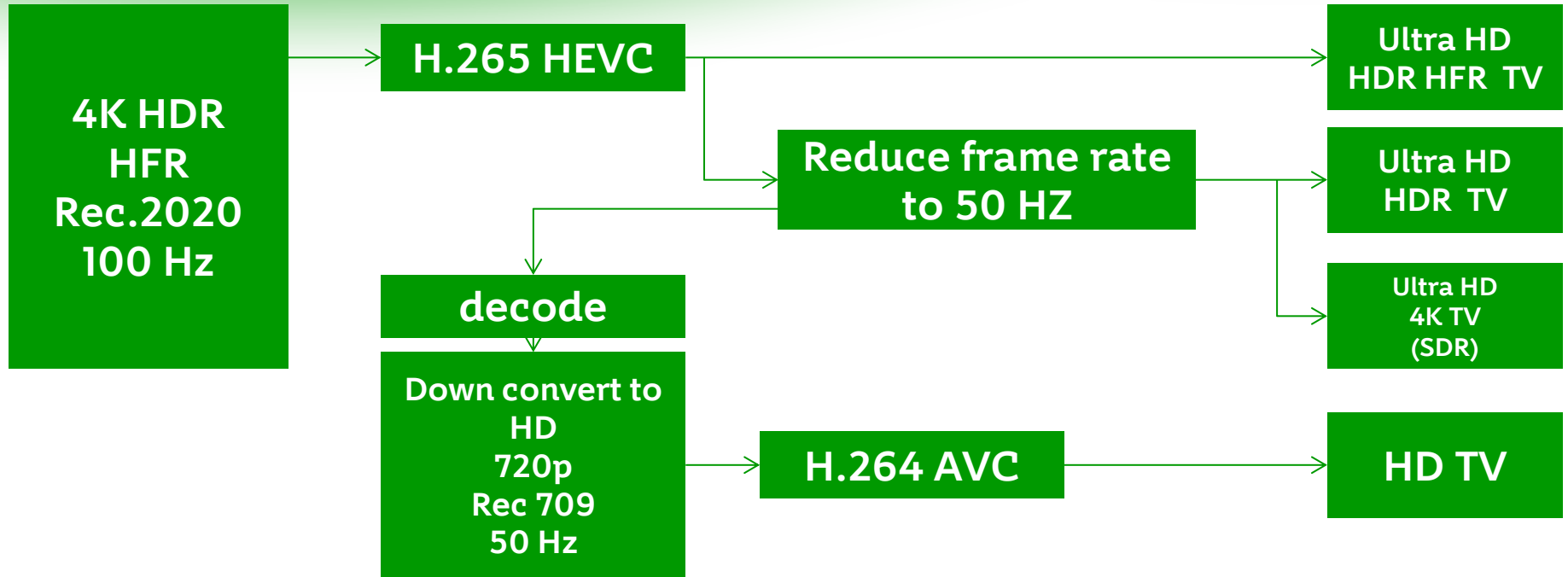
HDR HFR



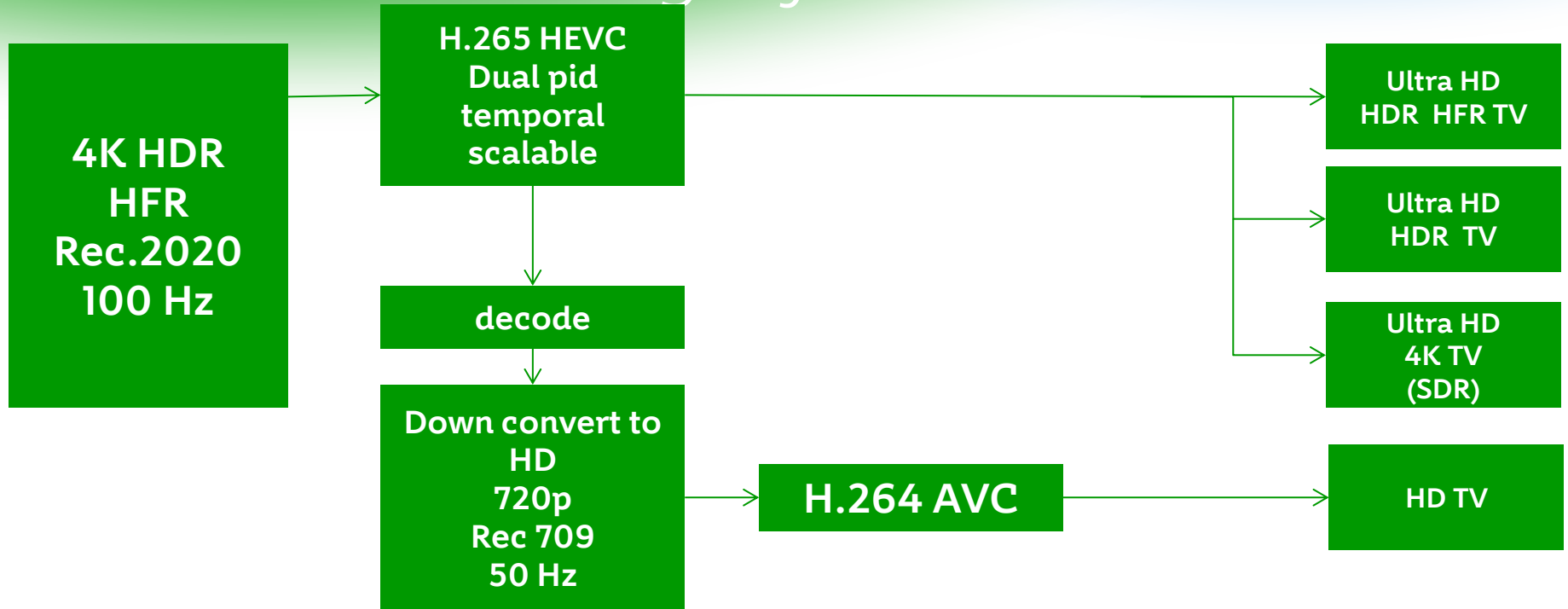
Simulcast 4K HDR HFR (using PQ) to 4K HDR and Legacy HD TV sets



Simulcast 4K HDR HFR (using HLG) to 4K HDR and Legacy HD TV sets



Simulcast 4K HDR HFR (using HLG) to 4K HDR and Legacy HD TV sets



Conclusions

- Both HDR10 and HLG are candidate solutions for IP TV distribution.
- HDR services will only reach latest TV sets (with HDR support).
- Simulcast in SDR 4K or SDR HD can be used as backwards compatibility option to reach all screens.
- Future introduction of HFR services potentially create similar problems and outdate TV sets sold today.

Thank you For your attention