



Ultra HD Reality

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Status of UHD implementation today

Looking ahead to UHD Phase 2

UHD Delivery – what's missing

UHD Forum Role

Moving Forward

Key UHD Definitions

WCG Wide Color Gamut

- BT 2020 color space

HDR High Dynamic Range

- NBC : HDR10 (BDA/DECE)
- BC (native) : HLG
- BC (single layer) : Technicolor, Philips, Dolby
- BC (dual layer) : Dolby

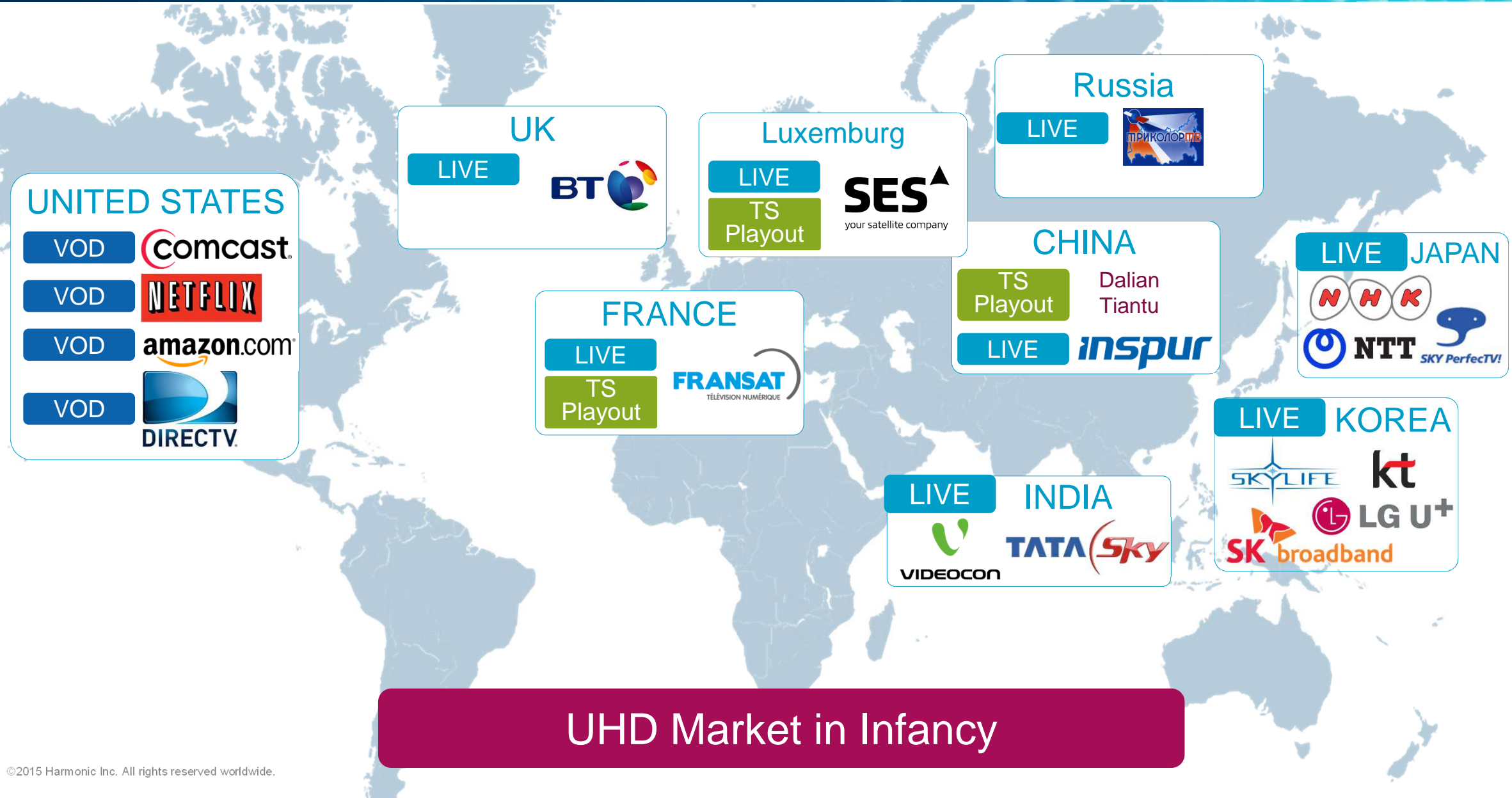
HFR High Frame Rate

- 100 / 120 fps for any resolution :
 - 1920 x 1080 x 100 / 2560 x 1440 x 100 (level 5.1)
 - 3840 x 2160 x 100 (Level 5.2)

NGA Next Generation Audio

- Object based coding
- Immersive audio
- Interactive audio

Deployed Ultra HD Services



Harmonic Powers First US UHD Channel

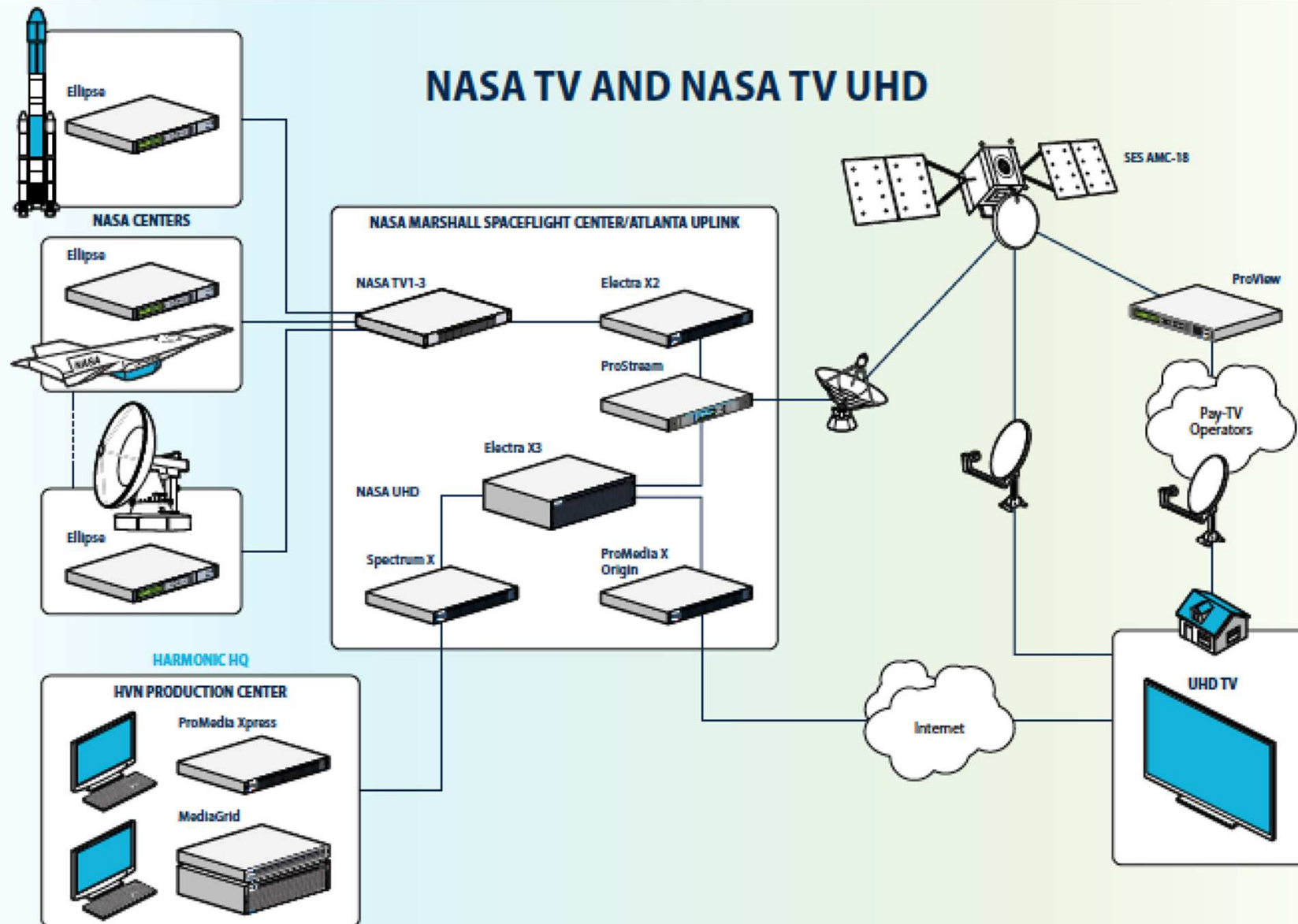
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- Ambient video channel with beautiful imagery from the space program
- Harmonic end-to-end UHD video delivery system delivers live and linear 2160p60 NASA content
- A test signal of NASA UHD is currently available on the AMC 18C satellite, with a North American footprint
- HDR 10 (HLG coming) demonstrated at CES'16 together with LG



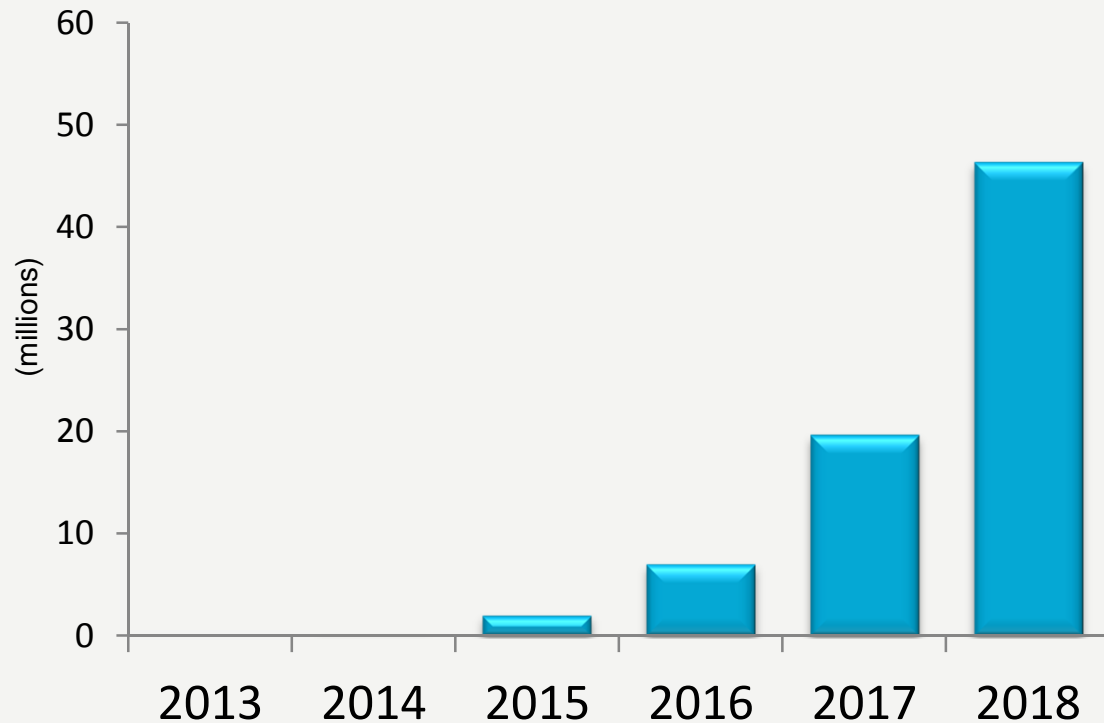
Harmonic Powers First US UHD Channel



Key Numbers

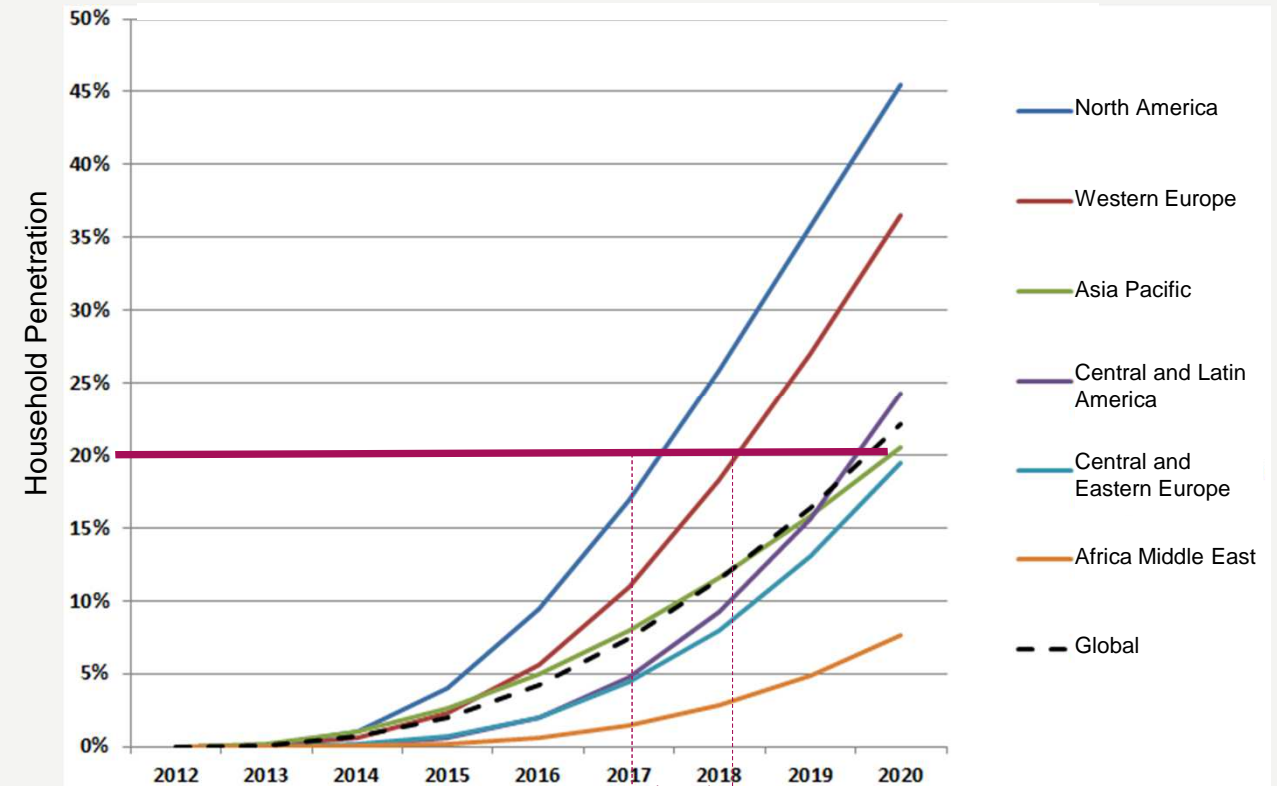
Global Subscribers of 4K Pay TV Services (2013 – 2018)

MILLIONS OF SUBSCRIBERS



Top Quality Video: The Emergence of 4K (and 8K)
© 2014 Parks Associates

Ultra High Definition TV Household Ownership by Region

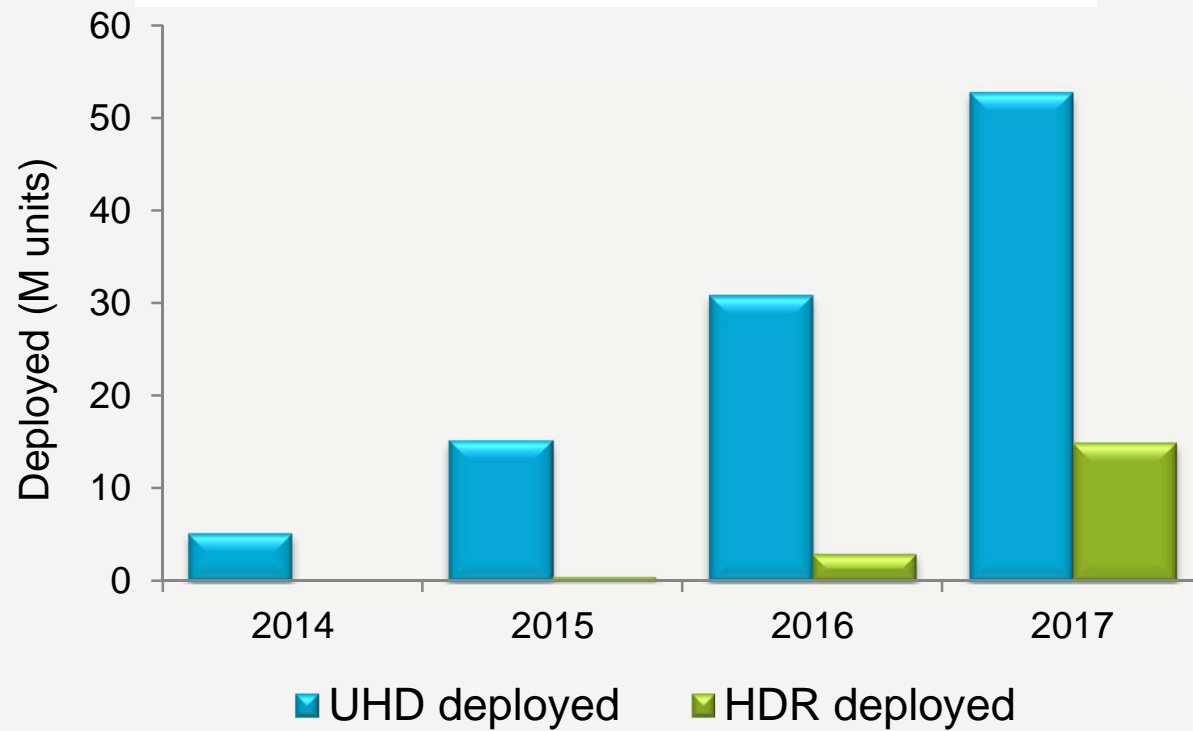


Strategic Analytics, March 15

Sweet Spot

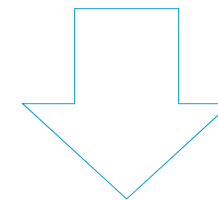
HDR Penetration

Ultra High Definition TV Deployed



Strategic IHS October '15

28% of UHD TVs deployed in 2017 are HDR



Need backward compatible scheme with SDR UHD TVs

SPECIFICATION

UHDTV1- Phase 1:

- HEVC Main 10 /L5.1
- BT 709
- No HDR
- No HFR
- Legacy Audio

SERVICES

- Mostly OTT
- nVOD
- Few Live services

CHALLENGES

- No buy in from Content Providers
- Broadcasters licenses not available for UHD
- No clear visibility into broadcaster plans
- Lack of HDR standard
- Premium content protection not available
- Service providers waiting for Phase 2

UHD Market Restricted Until Phase 2

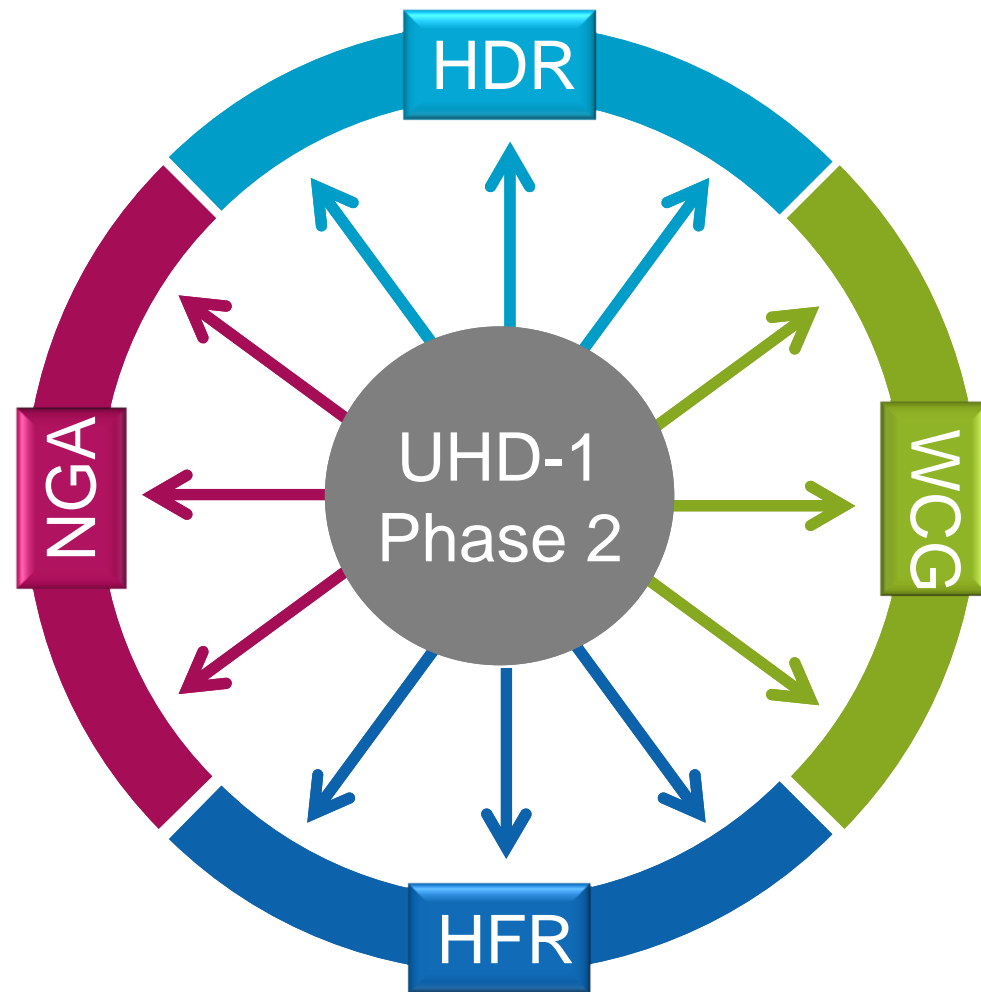
What is UHD Phase 2*?

ITEM	Phase 1	Phase 2	NOTES
Deployment	2014 - 2015	2016 - 2018	Services could start earlier
Codec	HEVC Main 10	HEVC Main 10 Evolution	Decision – June 2015
Maximum resolution	3840 x 2160 x 60	3840 x 2160 x 120	
Maximum MPEG level	5.1	5.1 / 5.2	Multiple profiles
WCG	BT 709/ 2020	BT 2020	
HDR	No	Several options	SMPTE/ITU-R/DVB/ATSC
HFR	No	Several options	BC & Non BC
Backward compatibility	N/A	Yes	Phase 1 TV / Intra HFR
NGA	No	Several options	BDA/DVB/ATSC

A Bigger Jump than SD to HD Transition

* As of Oct.30th 2015 9am CET

UHD Phase 2 Challenges

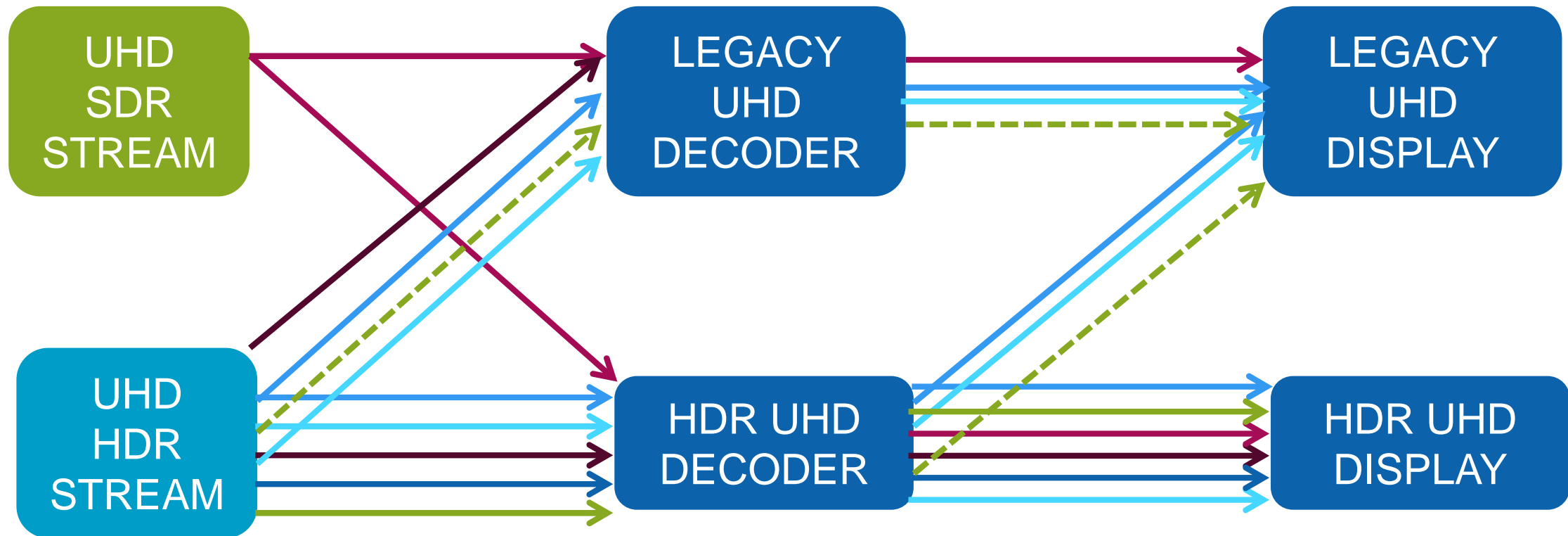


Broadcast decoder needs to support all combinations

ABR decoder can support only selected combinations*

** Pending adequate manifest creation by the Operator*

Broadcast Format Interoperability



- HDR 10 PQ
- Dual Layer (BT2020)
- - - → Base Layer (BT709)
- Decoder backward compatible
- Display backward compatible
- Hybrid Log Gamma
- SDR (BT709)

Ultra HD Delivery & Standards

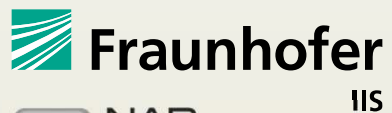
	<i>Broadcast</i>			<i>Multicast</i>	<i>Unicast</i>	
	<i>DTT</i>	<i>DTH</i>	<i>Cable</i>	<i>IP QoS</i>	<i>OTT</i>	<i>IP QoS</i>
DVB-TS	✓	✓	✓	✓		
DVB DASH					✓	✓
DASH Multicast				✓		
ASTC 3.0 ROUTE	✓				✓	✓

Current
 Extended
 Not Available
 Not Relevant for Europe

Growing Community



CHARTER



CONTRIBUTOR



ASSOCIATE



Ultra HD Forum Charter



VISION

Stimulate widespread consumer adoption of UHD and enhanced HD by enabling the availability of compelling content from many sources, including feature films, scripted, and live television content, and its distribution through all current and emerging avenues of delivery to consumers

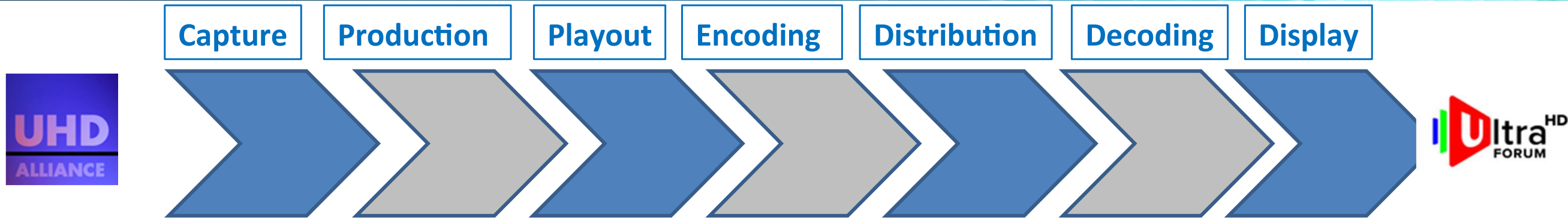
GOALS

- Facilitate the development, coordination, harmonization, and adoption of relevant standards and guidelines being developed in various media-related standard organizations and consortia
- Identify guidelines and inform the industry on best practices for the implementation of end-to-end systems for the generation, distribution, and rendering of next generation content
- Ensure handling the needs of real-time workflows with capture of live content for live and on-demand distribution through broadcast, multicast, and unicast deliveries
- Promote and organize Ultra HD media applications, deployments, and successes

DELIVERY

- The Ultra HD Forum is primarily a Business-to-Business (B2B) organization, and is **not a Standards Development Organization (SDO)**
- Technology is inclusive of ultra high definition resolution, high dynamic range, wide color gamut, high frame rate, advanced audio; the use cases of live, real-time, episodic, on-demand, broadcast, streaming, download and physical media distribution and other related technologies
- Facilitating interoperability tests, plug-fests and trials to demonstrate the usability and comprehensiveness of Ultra HD and related media standards
- Creating a central repository for relevant Ultra HD and related media workflows as well as members products & solutions
- Organizing industry-wide promotion events
- Producing white papers and the organization of informational “Master Classes” at major industry events and the demonstration of end-to-end solutions and proof of concept systems with common content created through diverse workflows



UHD Success = UHD Alliance + Ultra HD Forum



- Ultra HD Forum and UHD Alliance are complementary
- UHD Alliance is guaranteeing a consumer experience quality level through a logo program
- UHD Forum is focused on interoperability and best practices for the end to end ecosystem



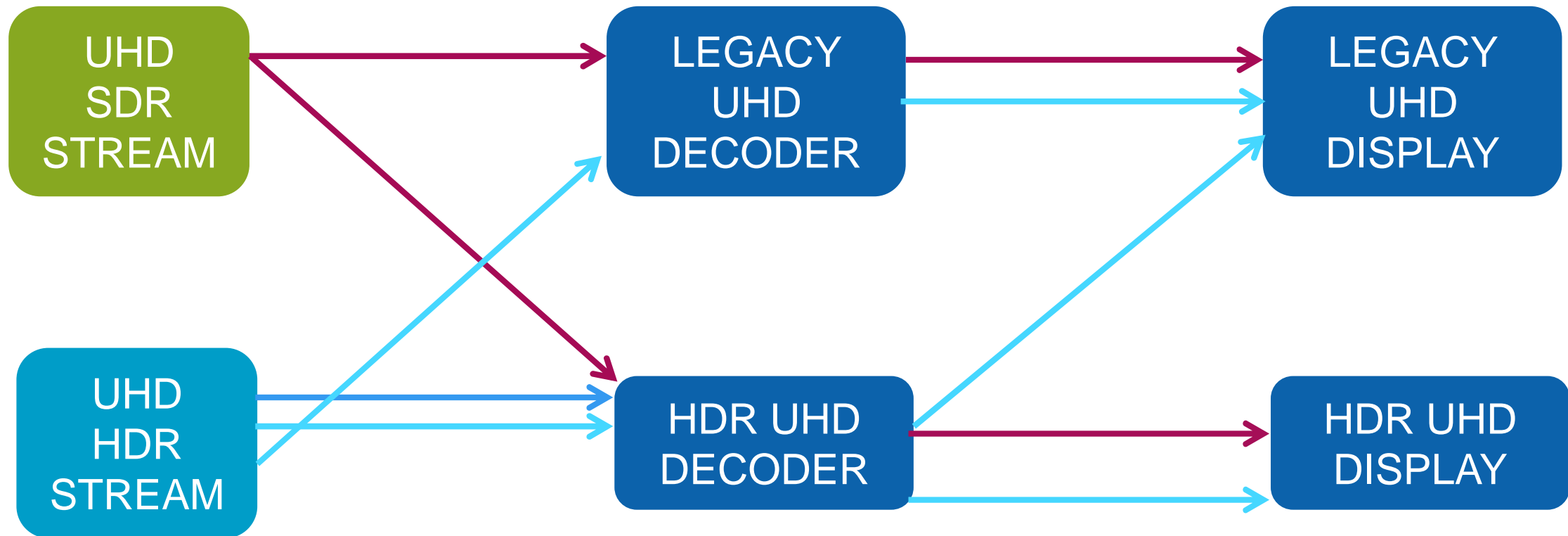
Recommendations

Item		
Publication	CES'16	NAB'16
Application	VoD / OTT	Live / Broadcast
Deployment	2016	2016
Codec	HEVC Main 10	HEVC Main 10
Maximum resolution	3840 x 2160 x 60	3840 x 2160 x 60
WCG	BT 2020	BT 2020
HDR	ST 2084*	HDR-10/HLG
Backward compatibility	Receiver based	HE based
Audio	NGA recommended	5.1

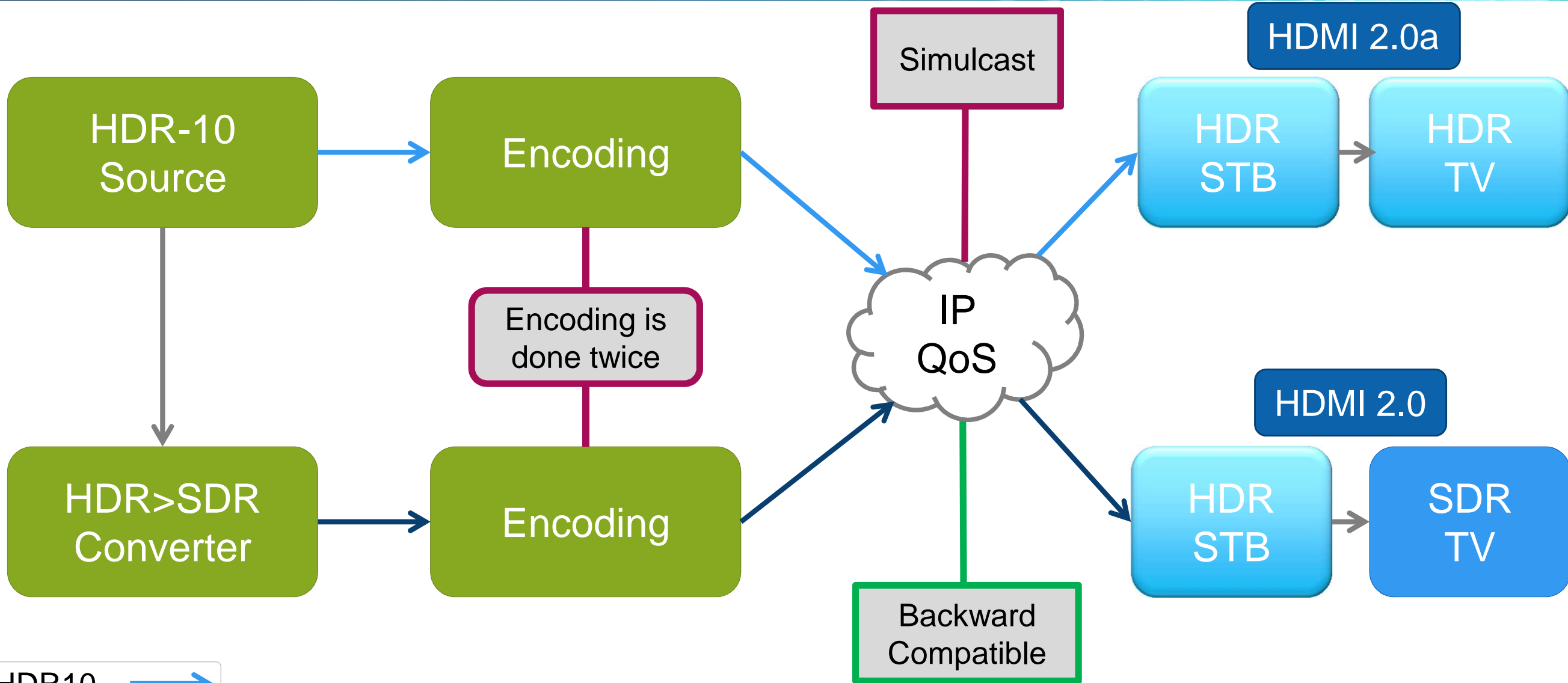
* HDR10, DV, Technicolor-Philips

Good alignment between recommendations

Ultra HD Forum Proposed Phase A



2016 HDR10 Expected Workflow

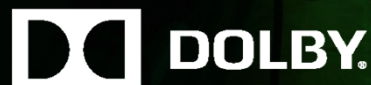


- Ultra HD Phase 1 had so far a limited success
- Phase 2 brings additional benefits to make it take off
- Phase 2 will require massive Video Work Flow transformation
- Content providers need to clearly understand all the subtleties (HDR, HFR, BC, NGA) and plan a 100 fps / IP workflow
- Europe is behind today in terms of deployments, but leading (DVB, EBU) with a complete Phase 2 ecosystem
- Ultra HD forum will facilitate UHD deployments across all networks

Harmonic is committed to UHD, actively participating to the UHD Forum, MPEG, DVB, ATSC, SMPTE



The Complete UHD Guidebook – A Reference Tool for Next-Generation Video



<http://info.harmonicinc.com/Ebook-UHD-Guidebook>

Thank You

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