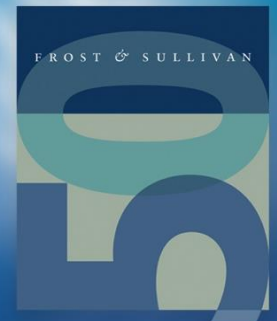


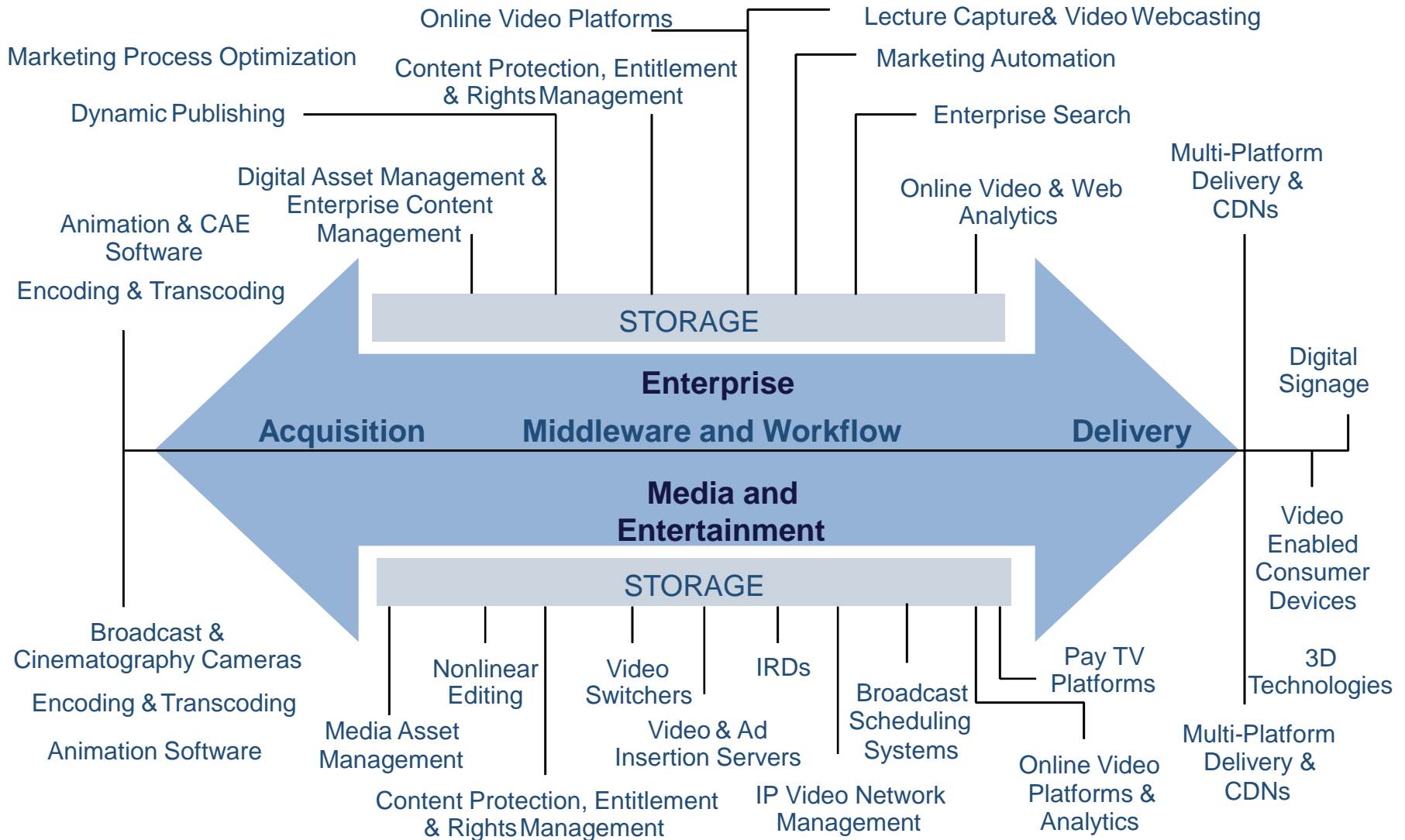
# Codec Battles Revisited: HEVC vs AVC (and VP9) in 2016

AVC whenever you can; HEVC when you must

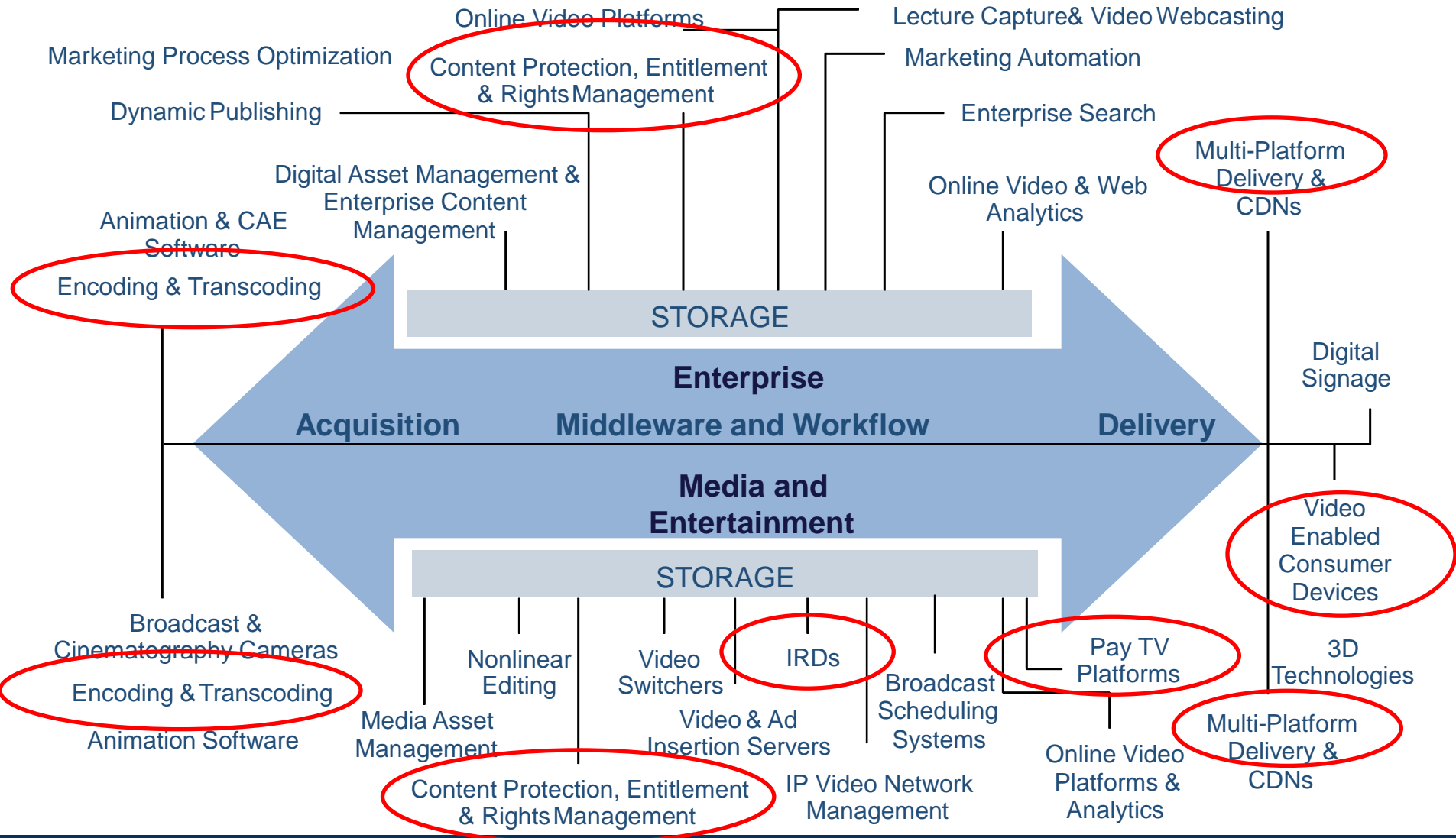
Avni Rambhia, Principal Analyst  
Digital Media



# Digital Media @Frost\_Sullivan: Research Coverage



# @Avni\_FS @Frost\_Sullivan: Research Coverage



# Overview

- Takeaways in a Nutshell
- A Good Year for HEVC
- Challenges and Risks for HEVC
- AVC v/s HEVC: Today, 2018, 2020
- HEVC Device and Channel Forecasts
- The Enterprise Bifurcates Toward VP9
- Concluding thoughts

# Key Takeaways

1 HEVC has almost crossed the chasm. Device footprint is growing. Encoder growth rates are high, though numbers remain small.

2 AVC remains competitive for HD or lower; HEVC uptake rising mainly with (slow) growth of 4K & HDR.

3 Reprogrammable/software-defined video products offer best protection of investment against format uncertainty and unpredictable growth trajectories.

Source: Frost & Sullivan analysis.

# Strong Strides Forward for HEVC

- **HEVC Advance rolls back the most onerous of licensing terms; loses Technicolor**
- **HDR specifications stabilized, and incorporated into HEVC specification.**
  - Two systems: PQ Curve (Dolby) and Hybrid Log-Gamma (NHK/BBC)
  - Select TVs with HDR already; new models expected to emerge quickly
  - HDR+HD more immediately compelling than HDR+4K; AVC unlikely to incorporate HEVC due to TV manufacturer pushback and lack of 10-bit support in consumer profiles
- UltraHD Blu-ray specification goes live; select players and some titles on sale already
- End-to-end product ecosystem in place although choices still limited
- Average encoder prices are now under \$50K per 4K channel and still falling
  - Silicon support also growing: e.g. Intel's new Skylake includes hardware-accelerated HEVC encoding and power-efficient decoding
- Main-10 client support also growing: Xbox One, Roku 4, 4K Smart TVs join Android devices.
  - HEVC support in Apple devices not certain
- Several OTT and Pay TV 4K services launched; STBs being preemptively deployed by service providers in anticipation of imminent service launches
- 4K infrastructure investments growing slowly but steadily (e.g. QuadAVC to 4K HEVC, 12G)
- Development of broadcast standards with 4K also progressing (ATSC 3.0, DVB-T2)
- Select greenfield services in bandwidth-challenged regions being deployed with HEVC

Source: Frost & Sullivan analysis.

# Challenges for HEVC and Applications

- **Repercussions from patent issues with HEVC Advance still linger**
- **4K is still an aspirational technology and marketing tool**
  - Continues to be difficult to recoup increased costs from incremental revenue
  - E.g. No official 4K Olympics broadcast due to lack of interest
  - The cost of a new encoder, while affordable, is a small fraction of total deployment cost
  - 4K content capture is increasing, but often to ease production of HD content
- 4K streaming reach is still limited, particularly for higher frame rates. Downloads continue to offer better quality but storage requirements are high
- Decoders and STBs still relatively expensive, though costs are falling & choice is growing
- HDR is currently difficult to product and deliver, particularly for live broadcasts. Lack of backward compatibility will also be an issue for some time
- Low density and slow encoding speeds limit applicability (or increase expense) for real-time applications
- As CDN costs continue to fall and AVC compression continues to improve, difficult to justify HEVC for HD and lower resolution services (MPEG-2 persists as well)
- For now, CPU can be thrown at AVC as much as HEVC for improved compression, buying some more time for companies to see how HEVC issues shake out

Source: Frost & Sullivan analysis.

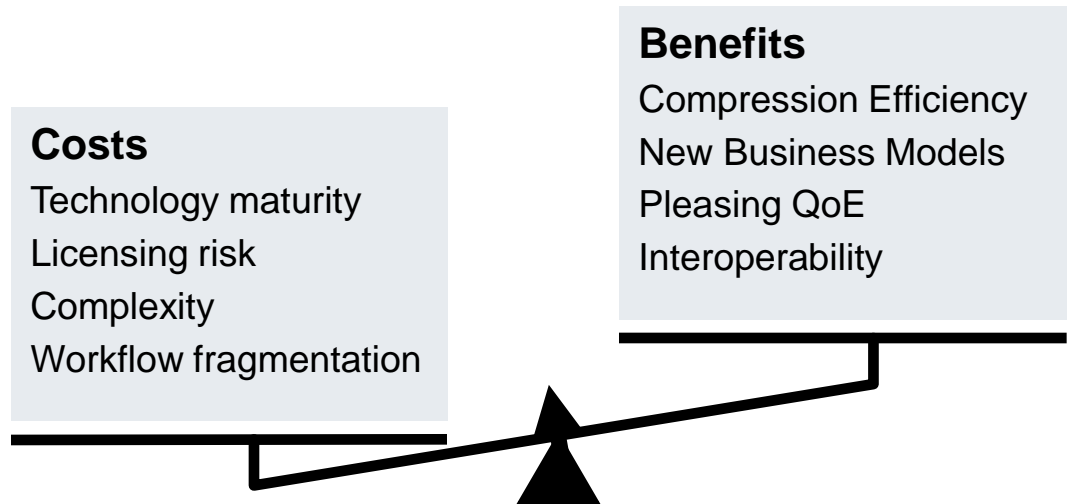
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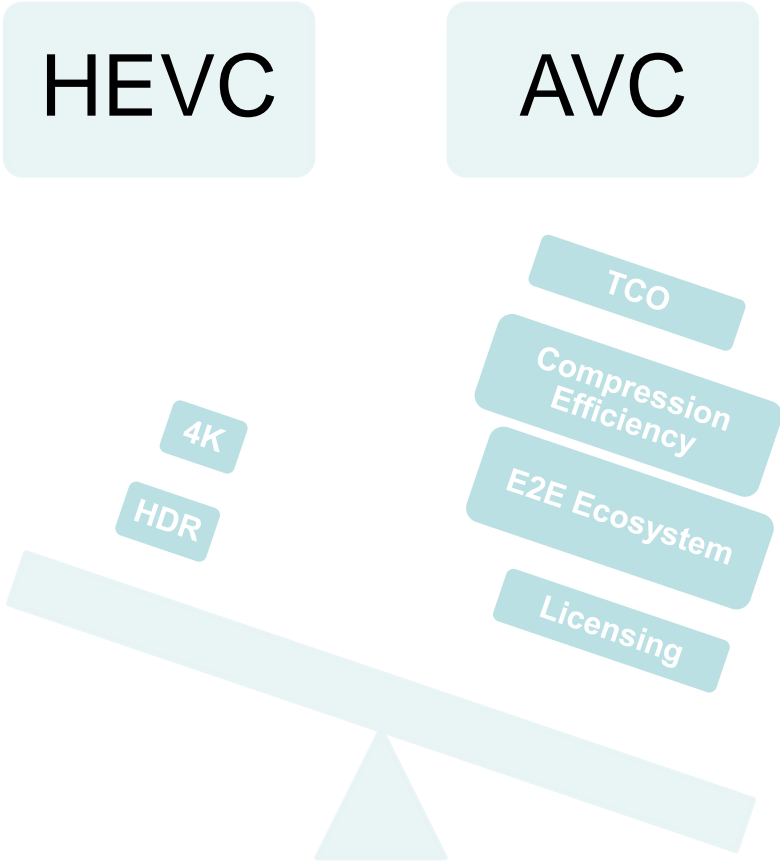
# Which Video Codec? Easy Answer: AVC until 2016

- The ubiquity and economy of AVC has been hard won.
- Widest reach and lowest **TCO** today for SD & HD
- State of the art AVC encoders can offer 2-4X improvement over earlier generations.
- Computationally maximized AVC can provide compression performance on par with HEVC implementations today
- Scale: throw cloud at the problem



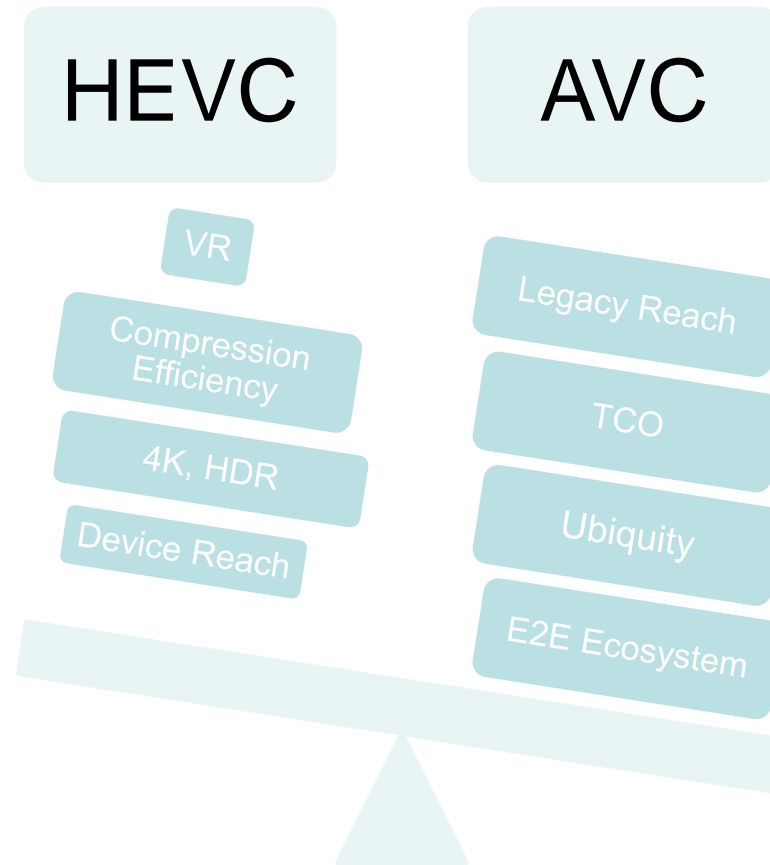
Source: Frost & Sullivan Analysis

# Factors To Tip the Balance: 2016



Source: Frost & Sullivan Analysis

# Factors To Tip the Balance: 2018



Source: Frost & Sullivan Analysis

# OTT Video Compression Choices: Updated from SMW15

	Suitability for HD	Suitability for 4K	Device/ Browser Footprint	Choice of Vendors	Licensing Risk	Standard & Ecosystem Support
AVC						
HEVC						
VP9 VP Next						

Standardized HDR support currently only available with HEVC

Decreasing 	Stable 	Increasing 
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	Strong		Weak
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Source: Frost & Sullivan Analysis

# Overview

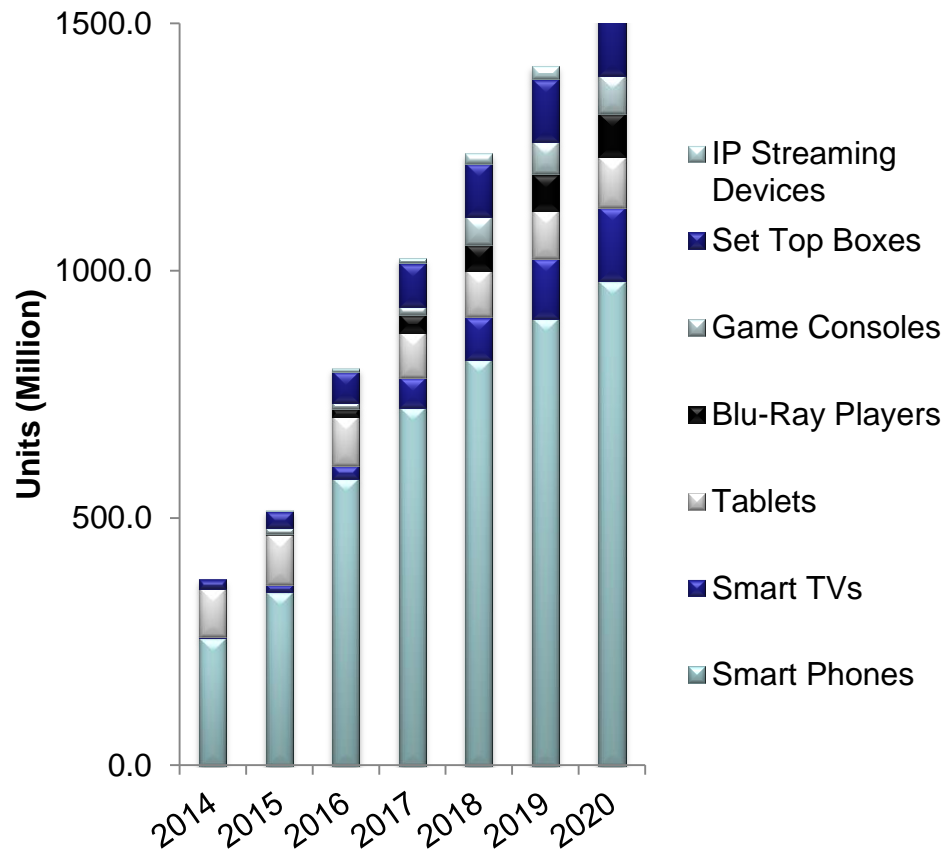
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# HEVC Enabled Device Shipments Updated from SMW15

- Chart does not count devices capable of support through aftermarket scenarios, such as download of software apps on earlier-year sold devices. PCs not counted
- 2016, estimated, in numbers:
  - Deployed video devices: >5B
  - New shipped video devices: ~3B
  - HEVC-enabled: ~800M (2X of 2014)
- Some risk of backwards slippage; we assume Android will not drop support and Apple will eventually add it
- Over half of video devices shipped in 2020 are expected to support HEVC
  - Natively integrated
  - Battery-efficient decoding/encoding
  - Secure playback

**Backward compatibility will be a non-trivial problem for HDR and DTT until 2018 at least, and will remain an issue until 2020**

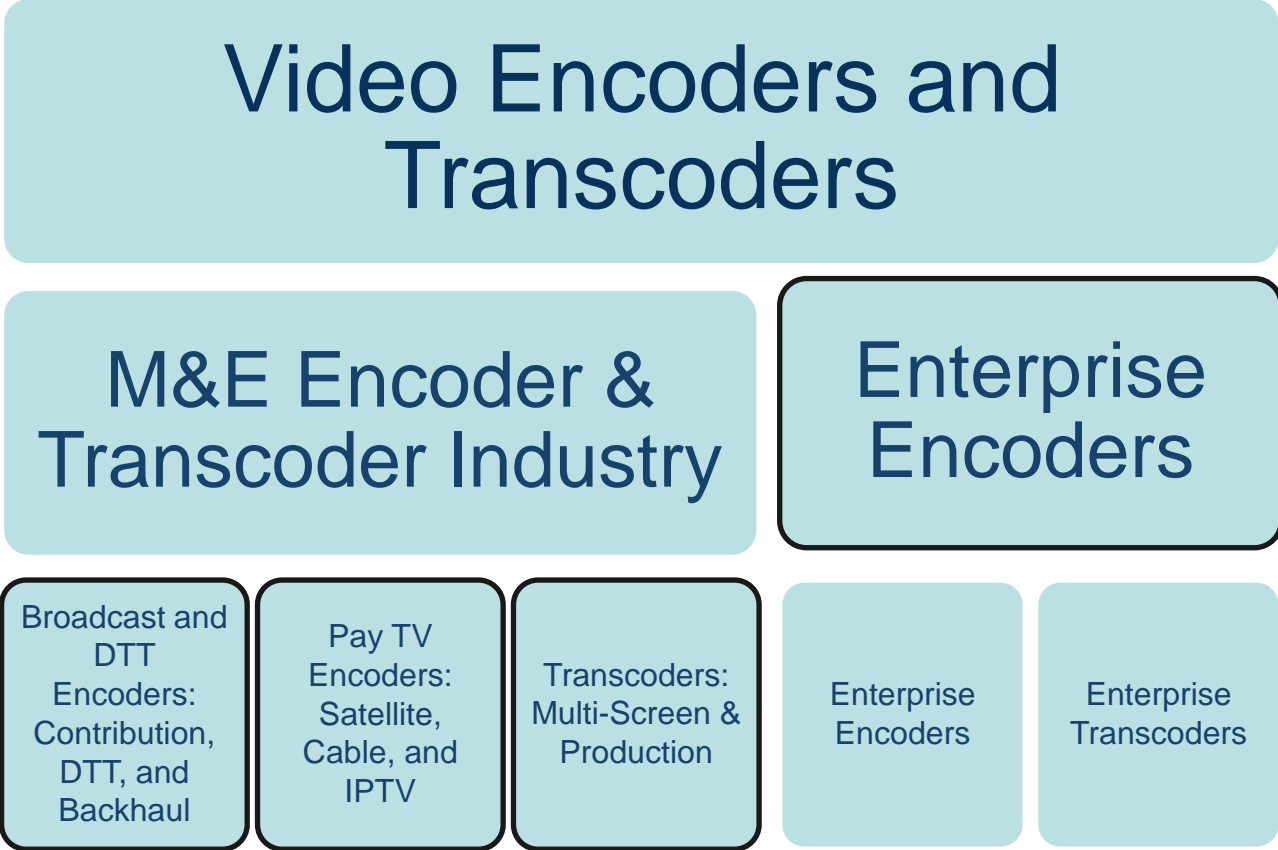
**HEVC-Enabled CE Devices: Unit Shipments, Global, 2014-2020**



Source: Frost & Sullivan analysis.

# Context for HEVC Revenue Forecast: Frost & Sullivan Taxonomy for Video Encoders and Transcoders

Rectangles circled in blue indicate individual market research services from Frost & Sullivan's Digital Media service.



Source: Frost & Sullivan analysis.

# HEVC Encoder Forecasts (M&E Applications)

- Enabled (as opposed to capable)
- Numbers still small, and also fluid:
  - Some 4K encoder sales reported as 4 HD encoder sales
  - For transcoding servers, channel counts not really apples-to-apples
  - Programmable encoders (enabled v/s capable) difficult to track
- That said...
  - Global HEVC encoder shipments estimated to cross 2,000 channels in 2016, up modestly from 2015.
  - 2X increase expected in 2017 and again in 2018 as more 4K and HDR-enabled services go live
- Most encoders deployed today are “software”. Towards 2018 we expect to see notable and growing share of “hardware”, but software-defined infrastructure will become increasingly pervasive for all classes of workflows.

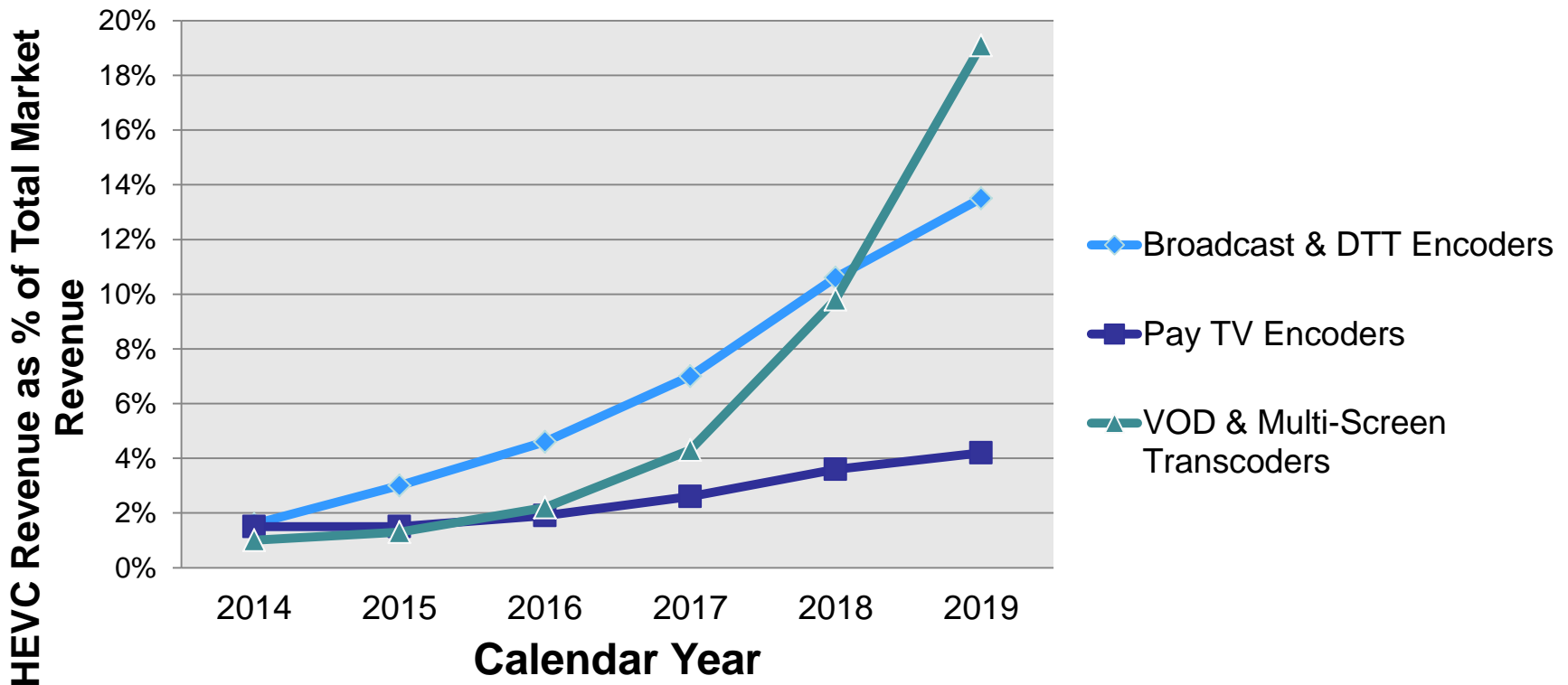
Source: Frost & Sullivan analysis.



# HEVC Revenue In M&E Video Encoder & Transcoder Industry

Key Takeaway: While total industry doubles from \$1B to \$2B, HEVC revenues grow nearly 15X but still likely to account for <\$250 M in revenues in 2019.

## HEVC-Enabled Revenue Relative to AVC and MPEG-2: Global, 2014-2019 (Total Revenue CAGR = 73%)



Source: Frost & Sullivan analysis.

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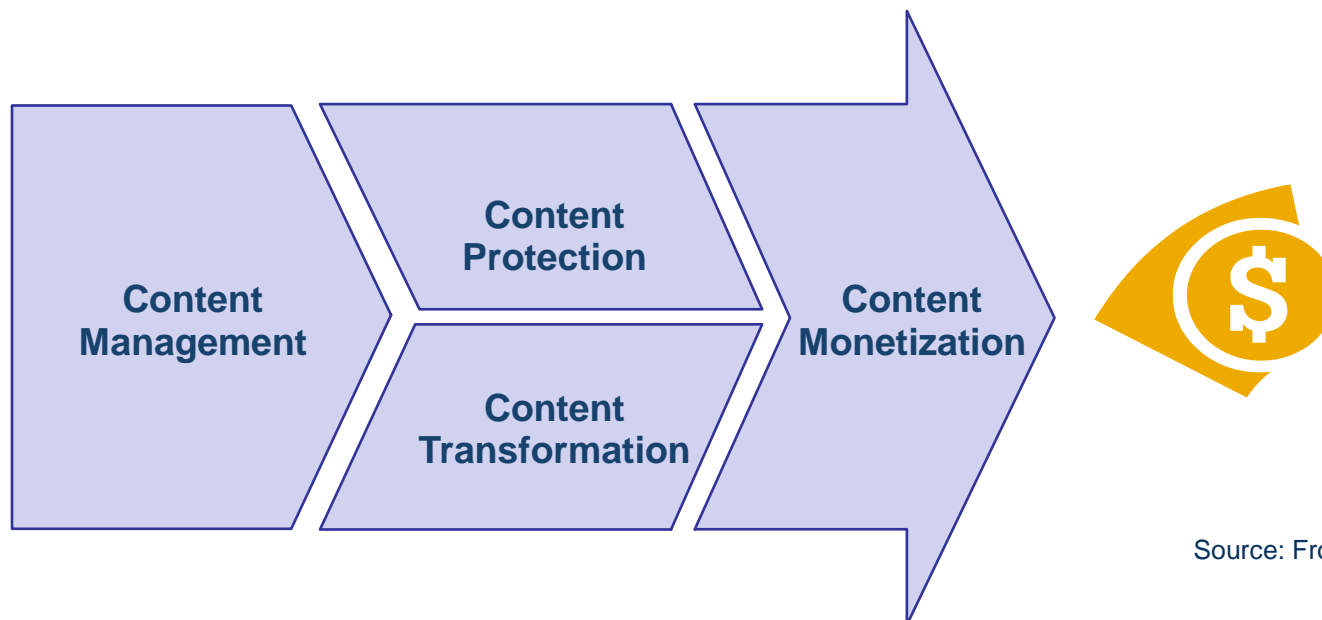
# Enterprise Uptake Is Diminished

- HEVC Advance debacle clearly impacted HEVC's expected surge of use in video conferencing. In its place, VP9, with improvements in SVC (scalable video coding), is taking root as complement/successor to AVC in video conferencing
- Most infrastructure and device companies serving enterprises are beginning to account for VP9; most devices are including support for VP9 due to YouTube; works well when DRM is not needed. Enterprise video creation and playback packages are following suit.
- In contrast to M&E, many enterprises and enterprise application vendors appear comfortable with any potential IP risks with VP9 in the shadow of several industry gorillas.
- Apple remains committed to HLS and AVC for now; future unclear.
- AOM's next codec is widely expected to serve as the enterprise replacement for AVC once finalized, with AVC and VP8/VP9 able to meet video needs in the interim.

Source: Frost & Sullivan analysis.

# How High is HEVC on Priority List?

- Rising in priority, but still not a critical must-have investment
  - Key challenge is increasing OTT service reach, quality and profitability, driven by competitive pressure & consumer demand
  - Higher broadband speeds, better targeted ads and device-centric experiences, cloud DVR are more urgent priorities
  - 4K more about marketing; HDR is cooler but still new/experimental



Source: Frost & Sullivan Analysis

# Closing Thoughts: Pick Your Battles

Most pressing challenges to online content businesses today are:

- Monetization and profitability
- Subscriber churn
- Scalability
- Differentiation



In the short term, these investments deserve strong consideration:

- Best of breed AVC encoder with optimized presets
- Cloud-based converged workflows
- Personalized experience, consistent across devices & screens
- Targeted advertising, driven by analytics
- Renegotiated CDN pricing

Source: Frost & Sullivan Analysis

# Acknowledgements (Selected)

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- Advantech
- ATEME
- CastLabs
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- Ericsson/Envivio
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- Harmonic
- Haivision
- HPE
- Intel
- Ittiam
- Microsoft
- Nanjing Yunyan Tech Ltd
- Neulion
- Roku
- QuickPlay
- Squid Systems
- Technicolor
- Telestream
- Vantrix
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- Wowza
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# For Additional Information

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