

Future of 8K Televisions

EE 786: Case Study Assignment



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Case Topic: The 8K TVs are here but will they succeed in the market?

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1. INTRODUCTION

The word 8k became a hot word in 2016 when the Japan's national broadcasting organization NHK live broadcasted the opening and closing ceremony of the Rio Olympics with an 8k resolution[1]. Although this was the first large scale public experiment, the initial draft for Super Hi-Vision video technology was submitted by NHK to Society of Motion Picture and Television engineers (SMPTE) and International Telecommunication-Union (ITU) in 2006.

Ultra High-Definition Television (UHDTV) includes two different standards: UHDTV1 and UHDTV2. The resolution of UHDTV1 is 3840×2160 which is commonly known as 4K technology and UHDTV2 have a resolution of 7680×4320 which is commonly known as 8K technology [2]. This resolution standard provides 4 times more pixels than 4K and 16 times of 1080p. The resolution of the 8K is the highest level of technology in the video and television at the moment, and is also the direction in which the developing.

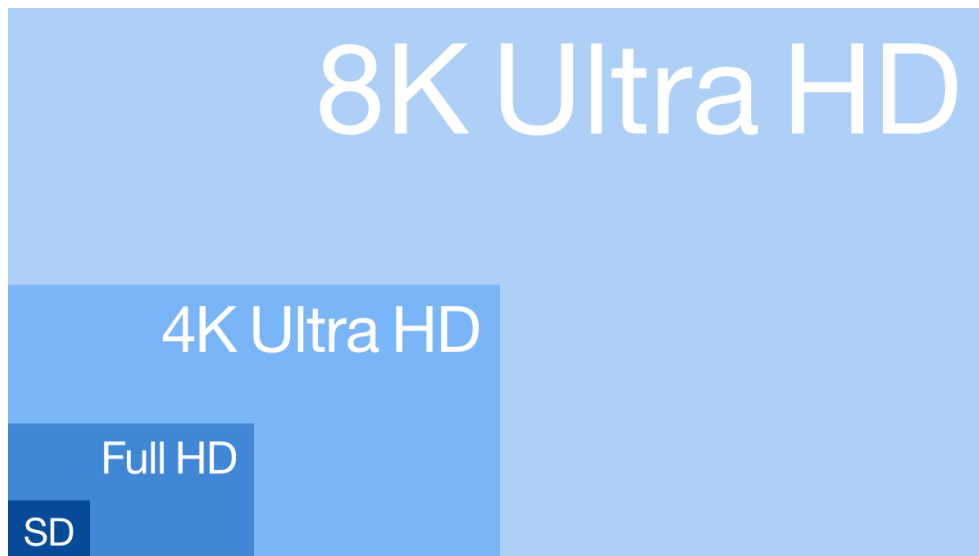


Figure 1. Resolution of 8K vs 4K vs 1080p vs SD

Road-map to 8K technology requires advancements in hardware, software and most importantly production of 8K content for consumers. One of the key step for widespread adaption of this technology is to reduce the cost of 8K panels and advancement in networks to provide uninterrupted streaming of content.

2. 4K vs 8K

4K (UHD-2) has been in the market for almost a decade. First 4K video was streamed by Netflix [3] in 2014. As of October 2020, there are around 189 UHD services, of which about 21% are on demand while the others are live. Of these 47% support High Dynamic Range (HDR) and 22% support Next Generation Audio (NGA) [4].

Even though 4K is popular, it's not well adapted by people yet. Even in developed countries like United States, there is no single 24/7 live UHD service. Countries like China deployed 4K services at the end of 2019 and had planned to include more 4K channels in 2020. Countries like France, Brazil and Italy have kept target of 2024 to deploy 4K. All this simply suggest that the 4K popularity have not yet peaked.

CE connectivity	HDMI 1.4a	HDMI 2.0	2.0a	2.0b	HDMI 2.1
MPEG Profile/Level	Main/4.1	Main/5.0	Main 10/5.1		Main 10/6.1
Resolution	1920×1080p		3840×2160p		7680×4320p
Frame rate	25/30fps		50/60fps		100/120fps
Color depth	8-bit		10-bit		12-bit
Color gamut	Rec.709		DCI-P3 / Rec.2020 WCG		
Dynamic range	SDR		HDR static metadata		HDR dynamic metadata
Audio	Multi-channel Audio (5.1-7.1)		NGA: ch-based		Next-Gen Audio: object-based
		2013 2014 2015	2016 2017 2018	2019 2020 2021 2022	
DVB Project	Pre-UHD	UHD-1 Phase 1	UHD-1 Phase 2	UHD-2	
Ultra HD Forum			Foundation Enhance		

Figure 2. Road-map from 4K to 8K

8K (UHD-2) is the natural evolution from 4K as it proposes more pixels using same technology as UDH-1 including HDR, NGA, High Frame Rate (HFR), Content-Aware Encoding (CAC) and wide color Gamut (WCG).

At the 2019 CES conference, 8K Association [5] was formed to promote the adoption of 8K. At the 2020 HPA (Hollywood Professional Association) conference, Warner Media presented the results of initial testing of 8K content versus 4K content displayed on 8K OLED TV [6]. The users noticed very little difference between 4K and 8K while watching variety of content showed at 30 fps. With these results and current technology, Hollywood community is not convinced for investing in 8K production.

3. CHALLENGES AND UPCOMING SOLUTIONS

For 8K to be a success there is a comprehensive need for development in software, hardware and content, specially in the following domains:

3.1. TRANSMISSION AND DISTRIBUTION

At IBC 2019 [7], Harmonic demonstrated single pass file-based cloud encoding showing promising results in High Efficiency Video Coding (HEVC) using Content Aware Encoding achieving bit-rates between 25 Mbps to 35 Mbps depending on content complexity. Although this is the best bit-rate generated till now, majority of the population cannot afford to have such high speed connectivity. Even

when people can afford it, it poses a risk of network congestion and data exhaustion. Active research is being conducted in this domain and is expected that in two to three years, this bit-rate is expected to drop below 20 Mbps using CAE [4].

3.2. CONTENT CONVERSION

8K content creation is still going to take time. To incentivize the consumers to adapt to 8K, there is a large consensus in the industry that the solution is to up-convert the content from 4K to 8K using a high-quality up-converter [6]. Infact Samsung have already introduced its ScaleNet [8] system that produces metadata to assist with up conversion on the TV side. Even though this sounds interesting, the drawback of such approach is that not all 8K TVs are equal and content quality is not controlled by the provider. Another solution to this is to convert the 4K content to 8K on the provider side by relying on AI or using super resolution techniques and produce best 8K, and then to sent the data to consumers. This approach comes with drawback of network bandwidth issues.

3.3. HIGH USER EXPERIENCE COST

8K TVs are likely to cost up to tens of thousands of dollars for premium models. A good 4K resolution TV is easily available for about \$ 300 whereas the starting price of 8K TVs is around \$ 1500 [9].

4. CONCLUSION

8Ks core attraction to consumers is as an option on the future of videos. Arguments like viewers will be seated too close or too far from screen, screen size is too big for room etc. were made for 4K too, but consumers have shows growing interest in 4K television sets. Infact, its projected that that the majority of the new TV buyers will opt for 4K in 2021 [9]. There is still a demand to mainstream the deployment of 4K. Moreover for consumers to adapt to 8K there is an active call for technology to mature, design of new codecs to reduce the bit-rate and most importantly the cost reduction of large size 8K panels. Content creation is another challenge faced by this technology which can be easily overcome if the demand of 8K televisions grows.

5. REFERENCES

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