

The Technology Behind Comcast's 30 Mbps

xfinity

**RealTime
4K**

Upscaled 4K Super Bowl Stream

4K

 **Dolby**
VISION

Dolby ATMOS



23:45

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RealTime
4K



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4K EVOLUTION



London
2012

Sochi
2014

Rio
2016

Pyeong
Chang
2018

2019
World
Cup

2020
Super
Bowl

Tokyo -
Beijing SB LVI
2021/2022

2024
Super
Bowl

2025
Super
Bowl

2026
Super
Bowl

REC

REC

VOD

VOD

LIVE

LIVE

LIVE

LIVE

Low Latency

Low Latency

LIVE POC

4K

4K

4K

4K

4K

HBR
4K

HBR
4K

4K

HDR

HDR

HDR

Dolby
VISION

Dolby
VISION

Dolby
VISION

Dolby
VISION

+ATMOS

+ATMOS

+ATMOS

LDP 5.x

STB

STB

STB

STB

STB

STB

+ATMOS

AD

Stream

STB

Stream

JPEG-XS

HIGH BITRATE

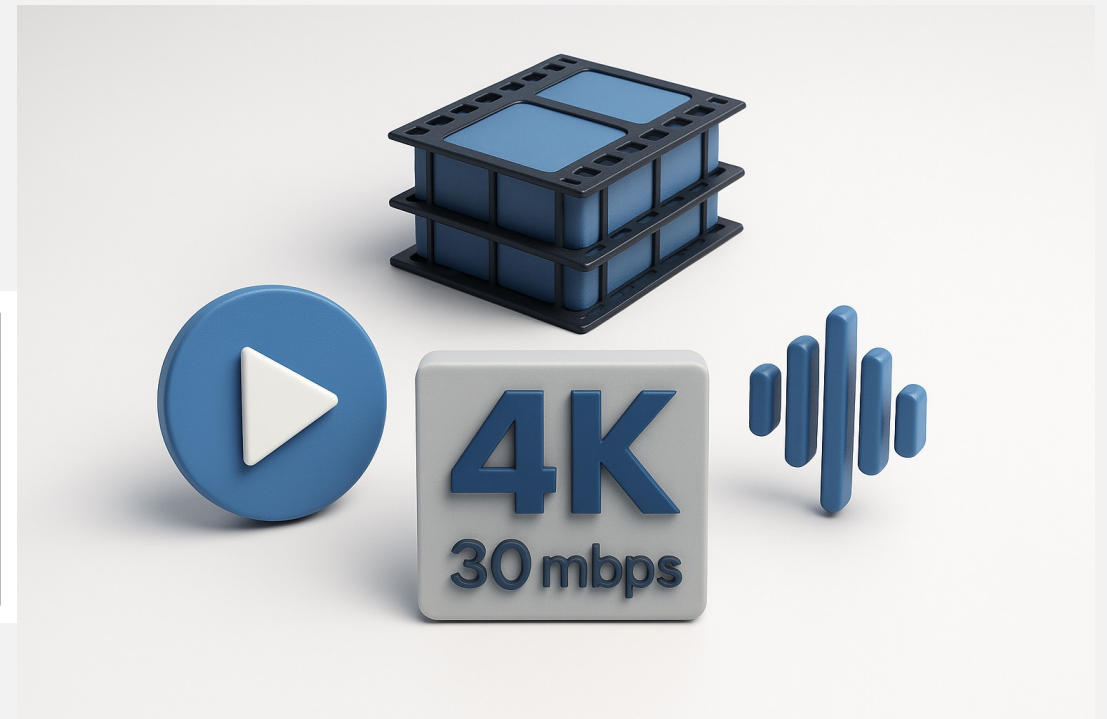
Audio:

Dolby Atmos as DD+JOC at 768 Kbps

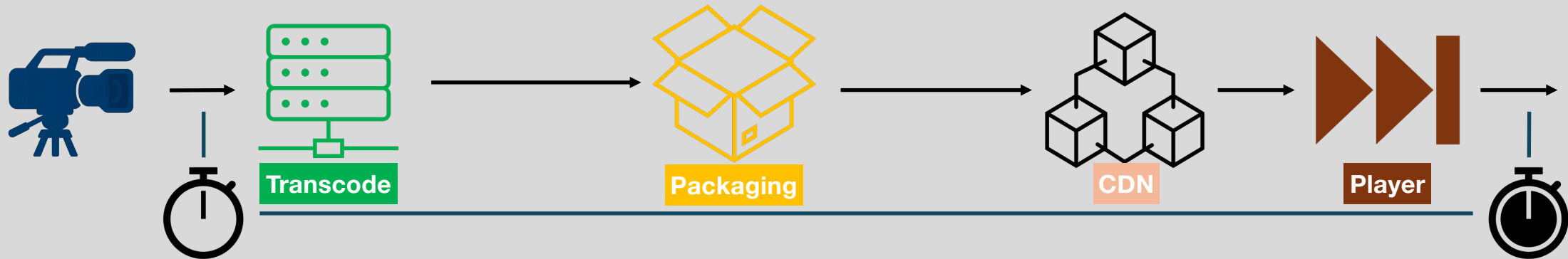
AAC-LC 2.0 at 128 Kbps

Video: HEVC Main10

Bandwidth	Resolution	Frame Rate
30 Mbps	3840x2160	59.94
18 Mbps	3840x2160	59.94
12.2 Mbps	2560x1440	59.94
5.8 Mbps	1920x1080	59.94
4.25 Mbps	1280x720	59.94
1.85 Mbps	960x540	59.94



Low Latency Approach



Previous



Target (6-9s)

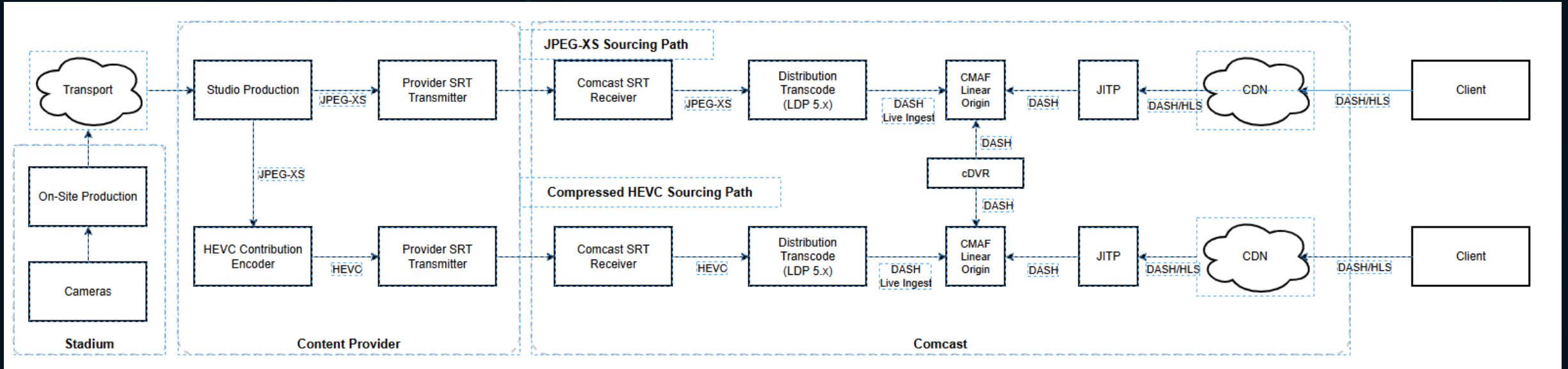


Key Enablers

- **LL-DASH**
 - CMAF fragment with HTTP/1.1 chunked transfer (LL-DASH)
- **DASH-IF live ingest protocol** for transcode and packager interface
- **Low-latency client-side rate adaptation algorithm**
- **Tradeoff among latency, efficiency, and quality**
- **Improved acquisition methods for reduction in upstream latency**

REALTIME4K LOW LATENCY WORKFLOW

- JPEG-XS in place of HEVC mezzanine
- Reduced latency
- Improved quality



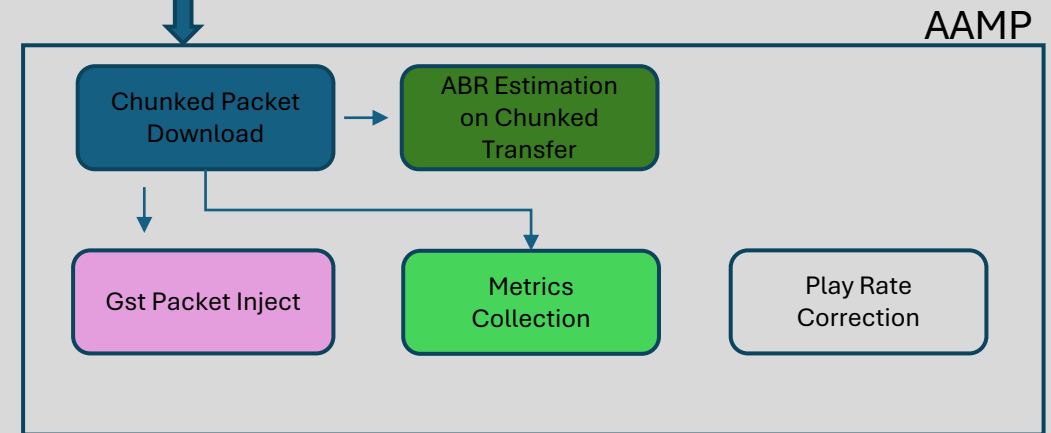
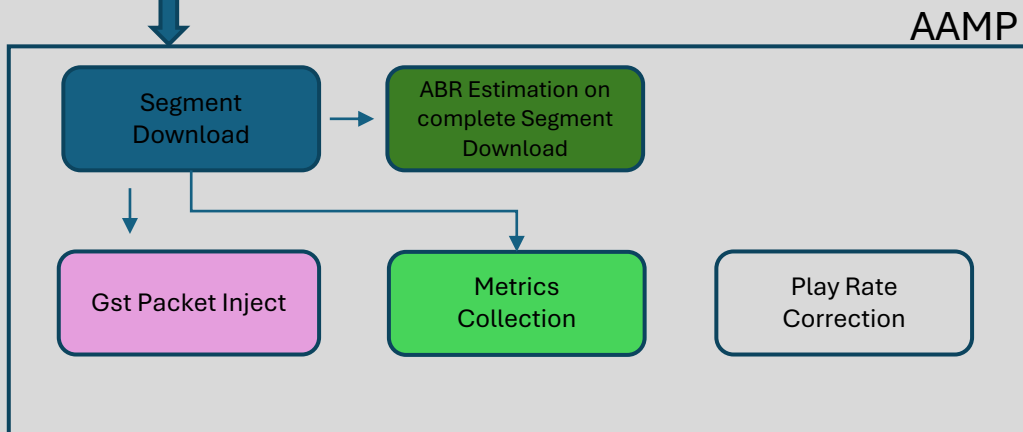
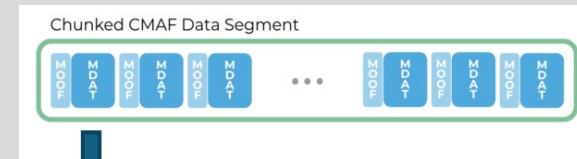
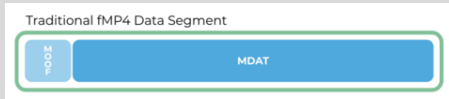
Live Offset / Latency in Player



PPV / Hot CDVR

LLD Offset

Non LLD Linear Channel

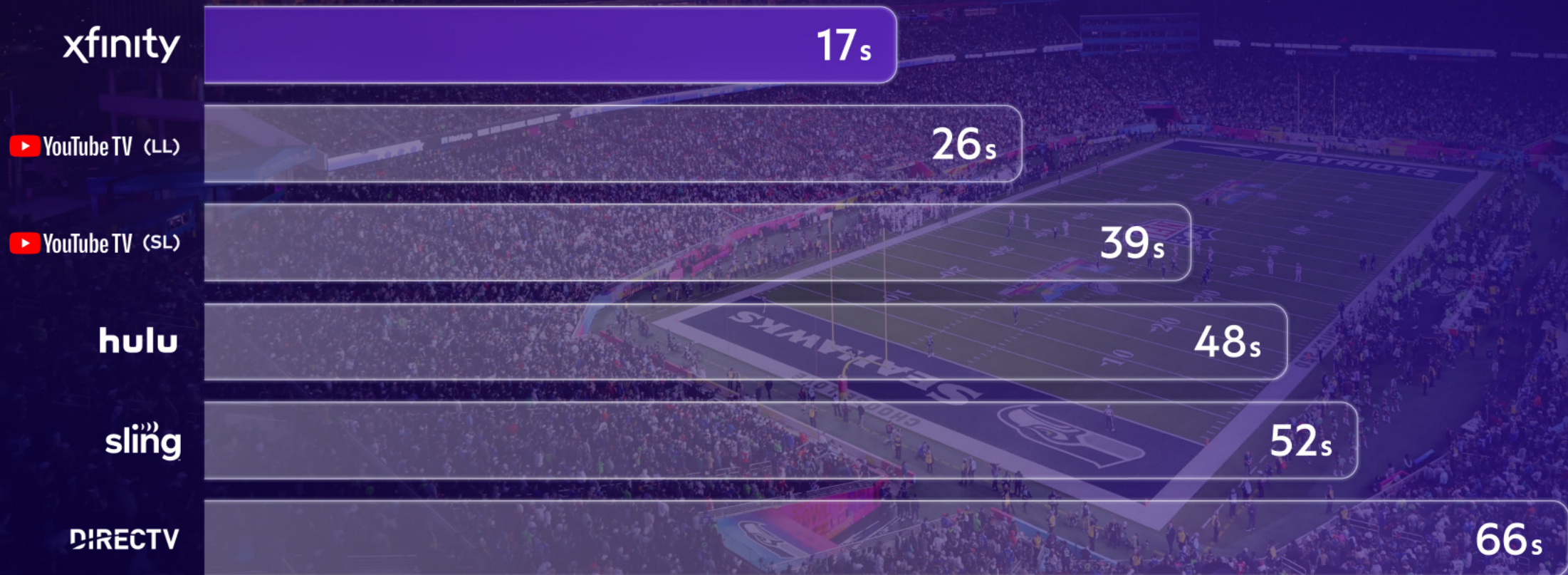


Xfinity Customers Saw Super Bowl LX First with *RealTime4K*

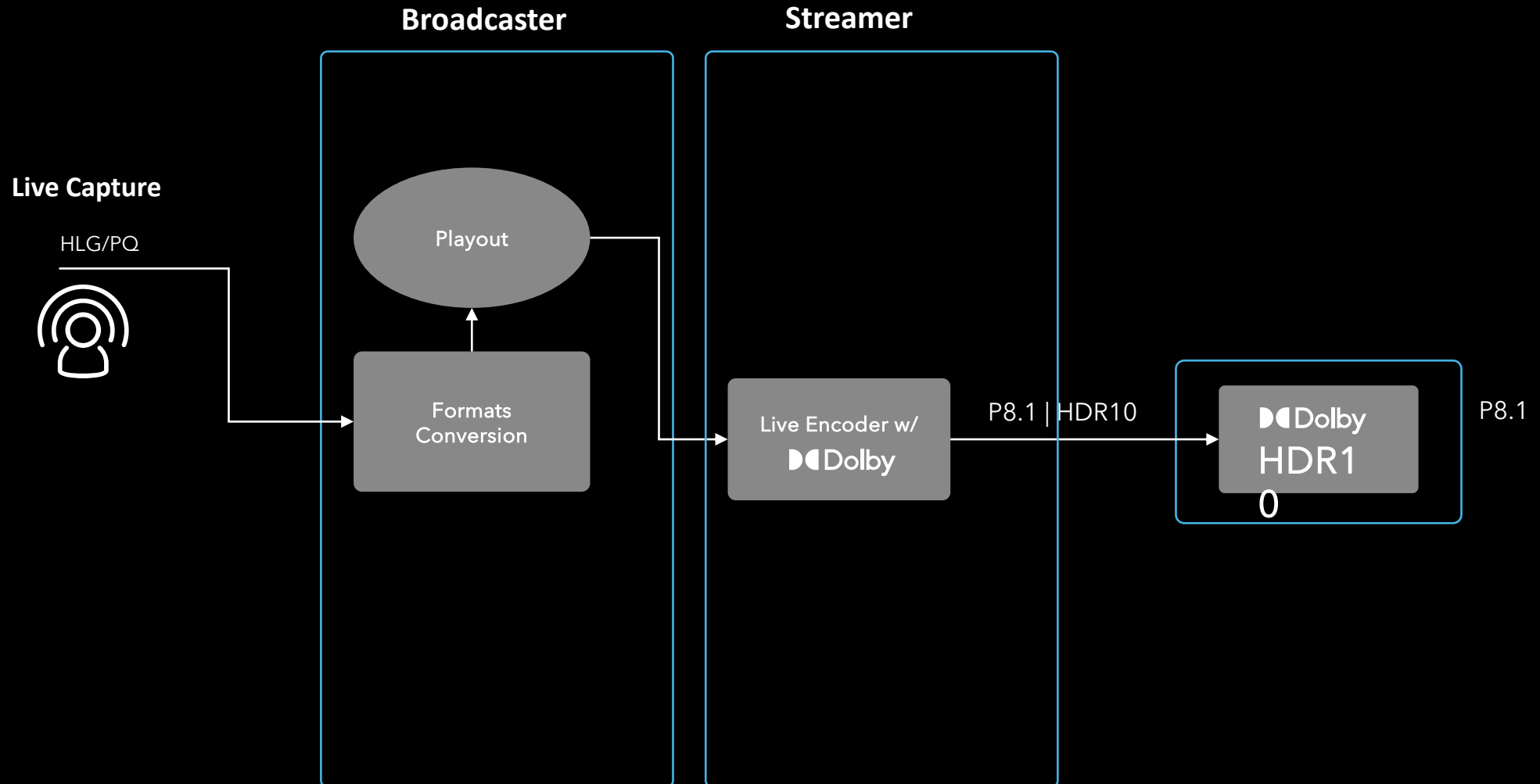
New Technology Delivered the Game 9 – 49 Seconds Faster Than Other Providers

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RealTime
4K



Dolby Vision contribution and distribution



New Dolby Vision features for live workflows - LDP 5

Improved L1 metadata analysis*

Creative L8 trims for live content, including up-trims*

Profile 8.1 metadata pass-through for transcoding

Automatic Picture Optimization (L11 metadata) - Defines content type and white point

*L1 metadata is the frame-by-frame metadata created by Dolby's Live Distribution Processor kit analyzing the incoming source

*Up-trims allows for content to be mapped to a higher brightness target than the content was created for: for example, 1,000-nit live content mapped to a display with 1,500 nits of maximum brightness

WHAT'S NEXT?

**“BEST OF” IS A MOVING TARGET.
EVOLVES WITH TECHNOLOGY**

- NEW CODECS?
- HTTP3?
- EVEN LOWER LATENCY
- CLIENT RESILIENCY

**PORTING THE DESIGN ELEMENTS AND
FEATURES FOR WIDER USE IN STANDARD
VIEWING EXPERIENCE**

- WORKING IN 3RD PARTY MULTI-CDN
- CMAF WORKFLOWS
- LOW LATENCY HD



THANK YOU



COMCAST