
AWS
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MDS208

FOX: Uncompressed live sports in the cloud

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COMPANY OVERVIEW

Fox Corporation produces and distributes compelling news, sports, and entertainment content through its iconic domestic brands, including FOX News, FOX Sports, the FOX Network, and the FOX Television Stations.

These brands hold cultural significance with consumers and commercial importance for distributors and advertisers. The breadth and depth of our footprint allows us to deliver content that engages and informs audiences, develops deeper consumer relationships, and creates more compelling product offerings.

FOX Entertainment's 30-year legacy of innovative, hit programming includes *9-1-1*, *Empire*, *Last Man Standing*, *24*, *The X-Files*, and *American Idol*.

Delivering high-quality scripted, non-scripted, and live content, its network is the only major broadcaster to post year-over-year ratings growth during the 2018-2019 season.

FOX Sports is the umbrella entity representing Fox Corporation's wide array of multi-platform US-based sports assets.

FOX Sports includes national networks FS1, FS2, and FOX Deportes, as well as FOX Soccer Plus, FOX College Sports, and a majority stake in the Big Ten Network.

FOX Television Stations owns and operates 208 full-power broadcast television stations in the US. In addition to distributing sports, entertainment, and syndicated content, our television stations collectively produce nearly 1,000 hours of local news every week.

FOX News Channel finished 2018 as the most-watched basic cable network for the third consecutive year in both primetime and total-day viewers and has held its number one national cable news channel status for 17 consecutive years.

FOX Nation launched in 2018 as an over-the-top streaming service to deliver premium content complementary to FOX News.

Sister network FOX Business Network is a financial news channel delivering real-time information across all platforms that impacts both Main Street and Wall Street.

COMPANY OVERVIEW

1.2 M

Assets stored in the cloud

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60,000

Hours of raw content annually

FOX Entertainment's 30-year legacy of innovative, hit programming includes *9-1-1*, *Empire*, *Last Man Standing*, *24*, *The X-Files*, and *American Idol*.

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16,000

Annual live event hours

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Previously on FOX moves to AWS



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MDS311-R1

Migrating live television distribution to the cloud, featuring FOX

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SVP Distribution Architecture, Media & Broadcast
FOX Corporation

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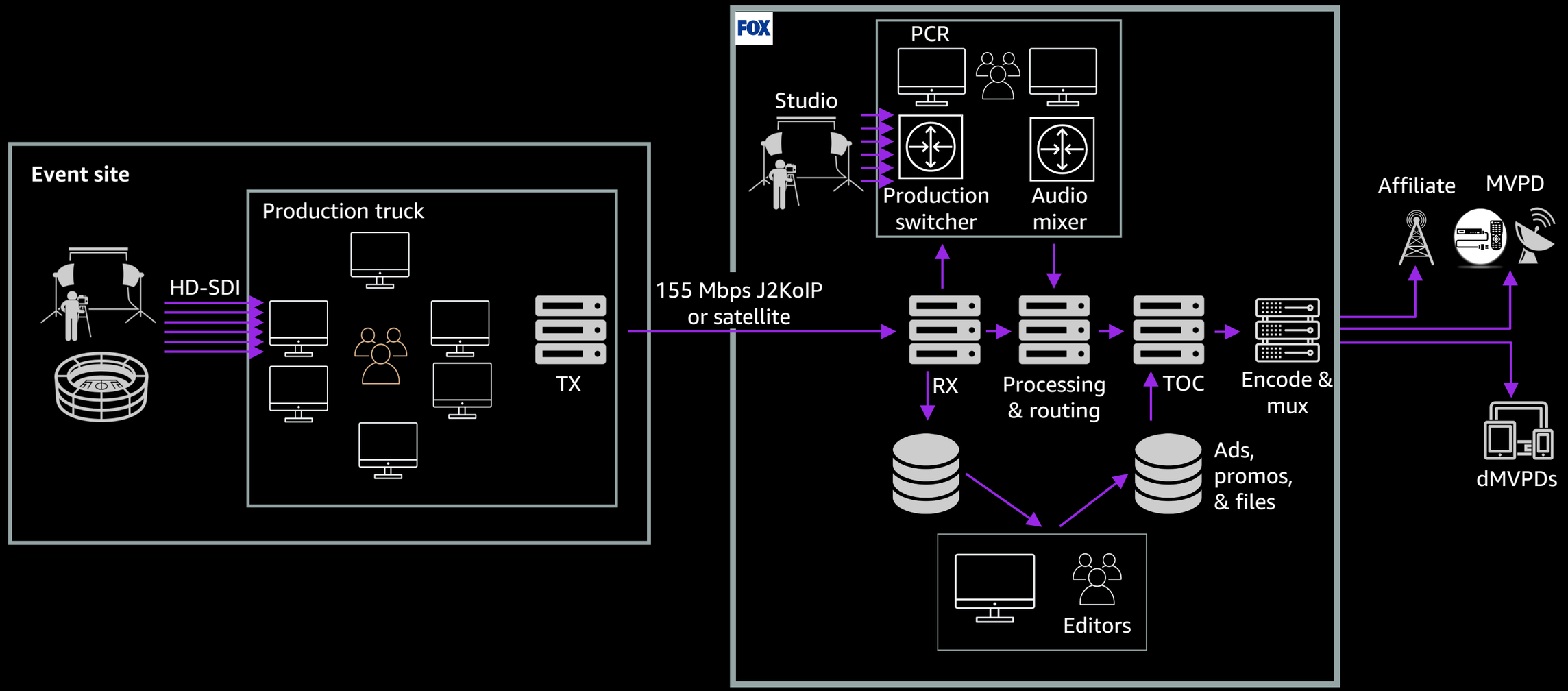
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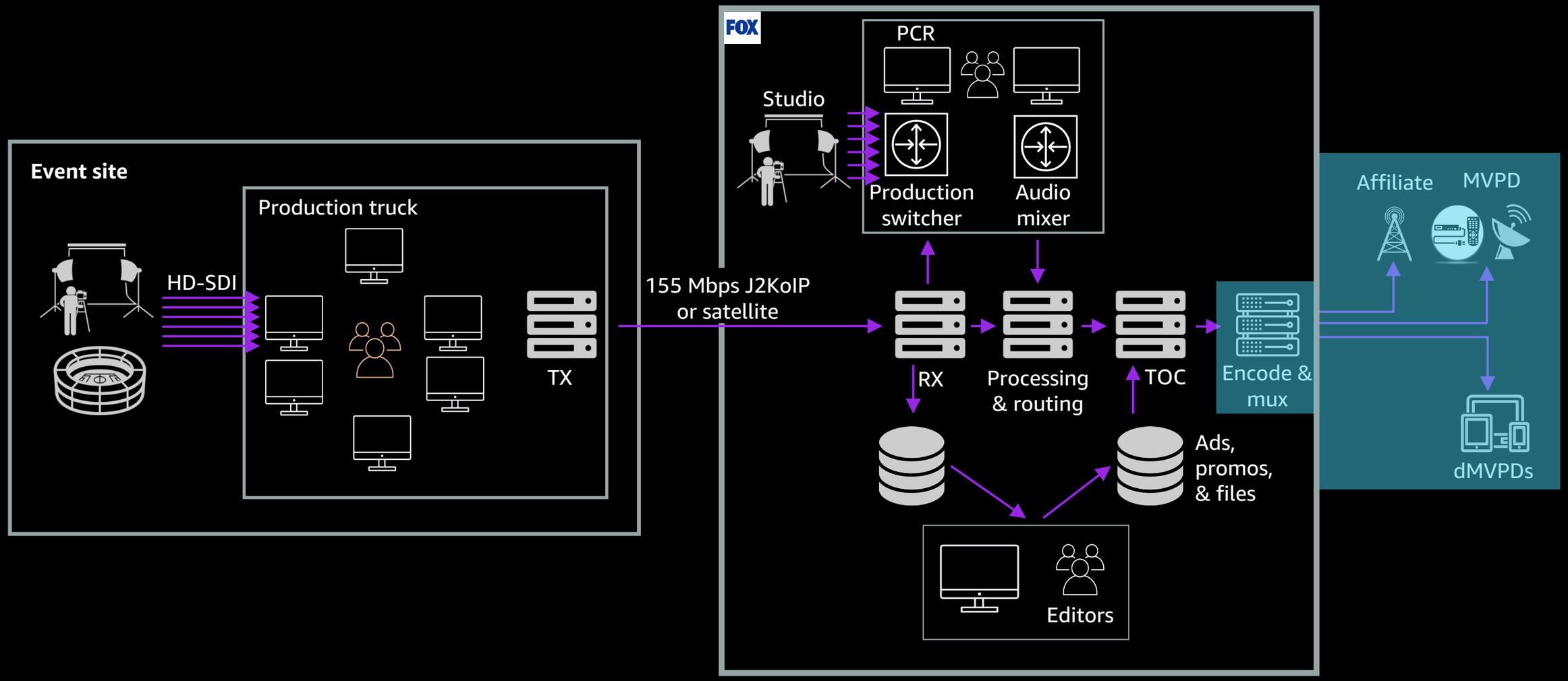
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Live broadcast channel

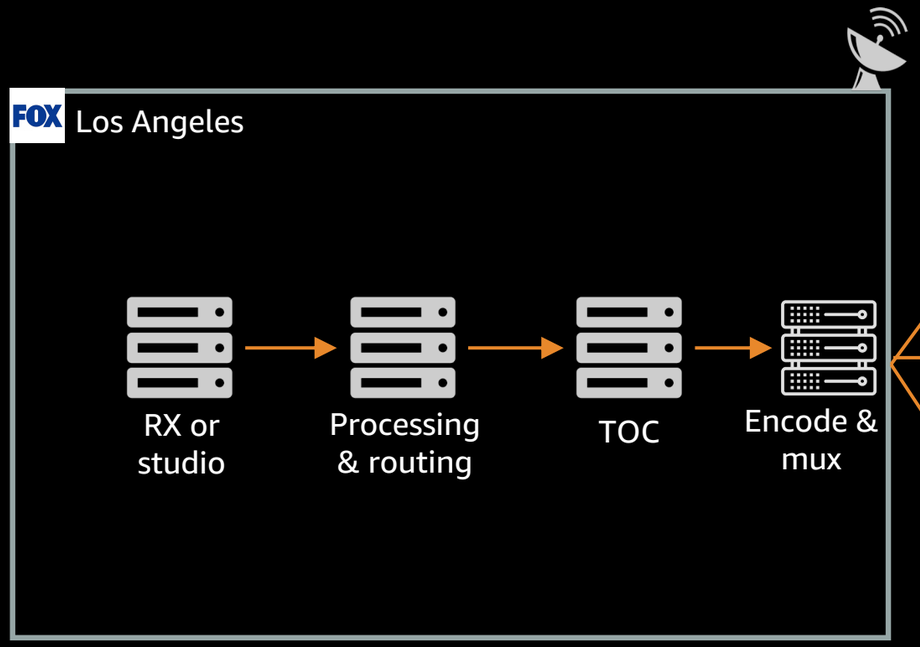


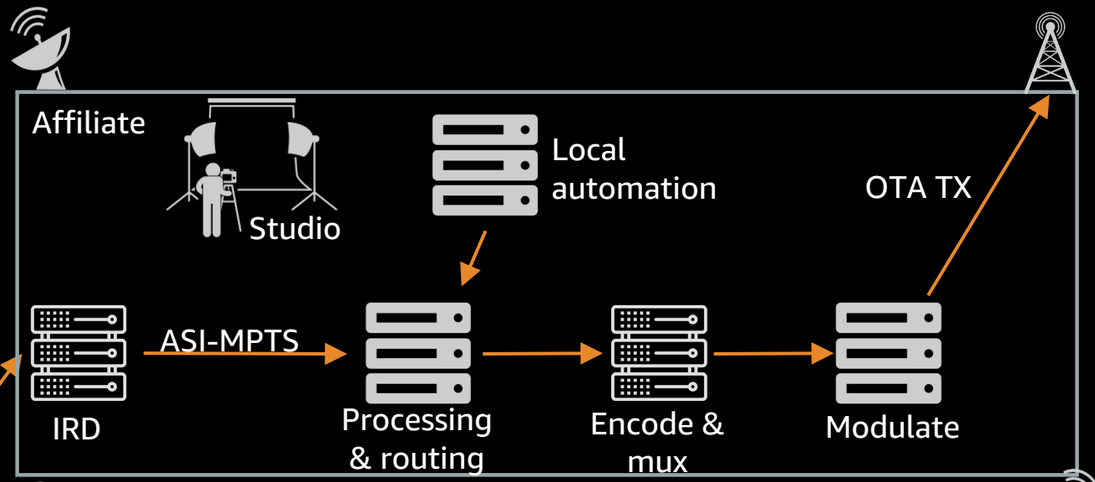
Area of focus for FOX: Linear distribution

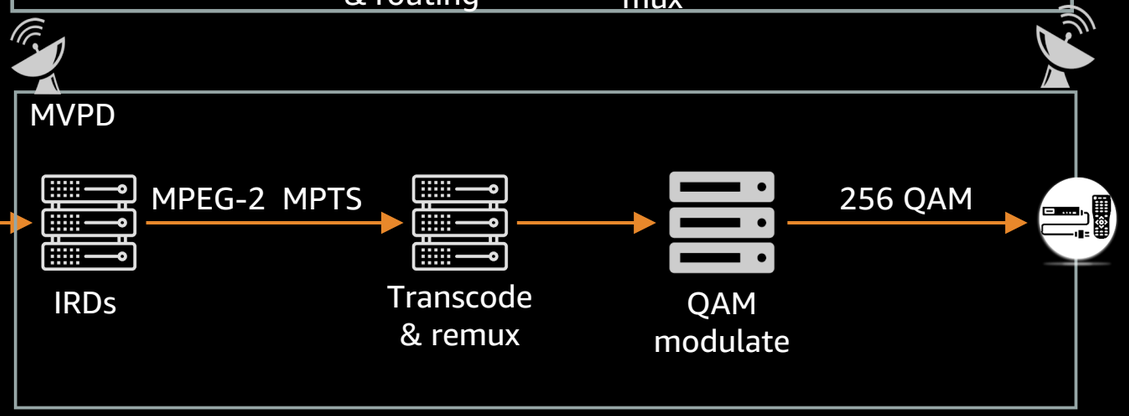


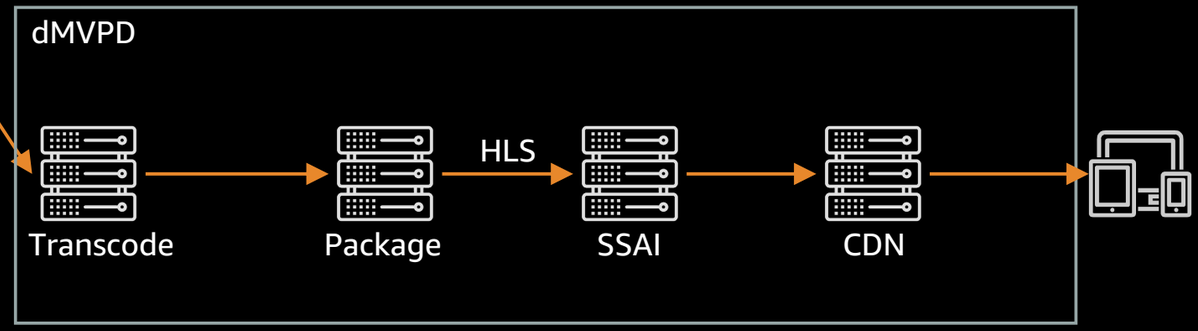
Television delivery pipeline







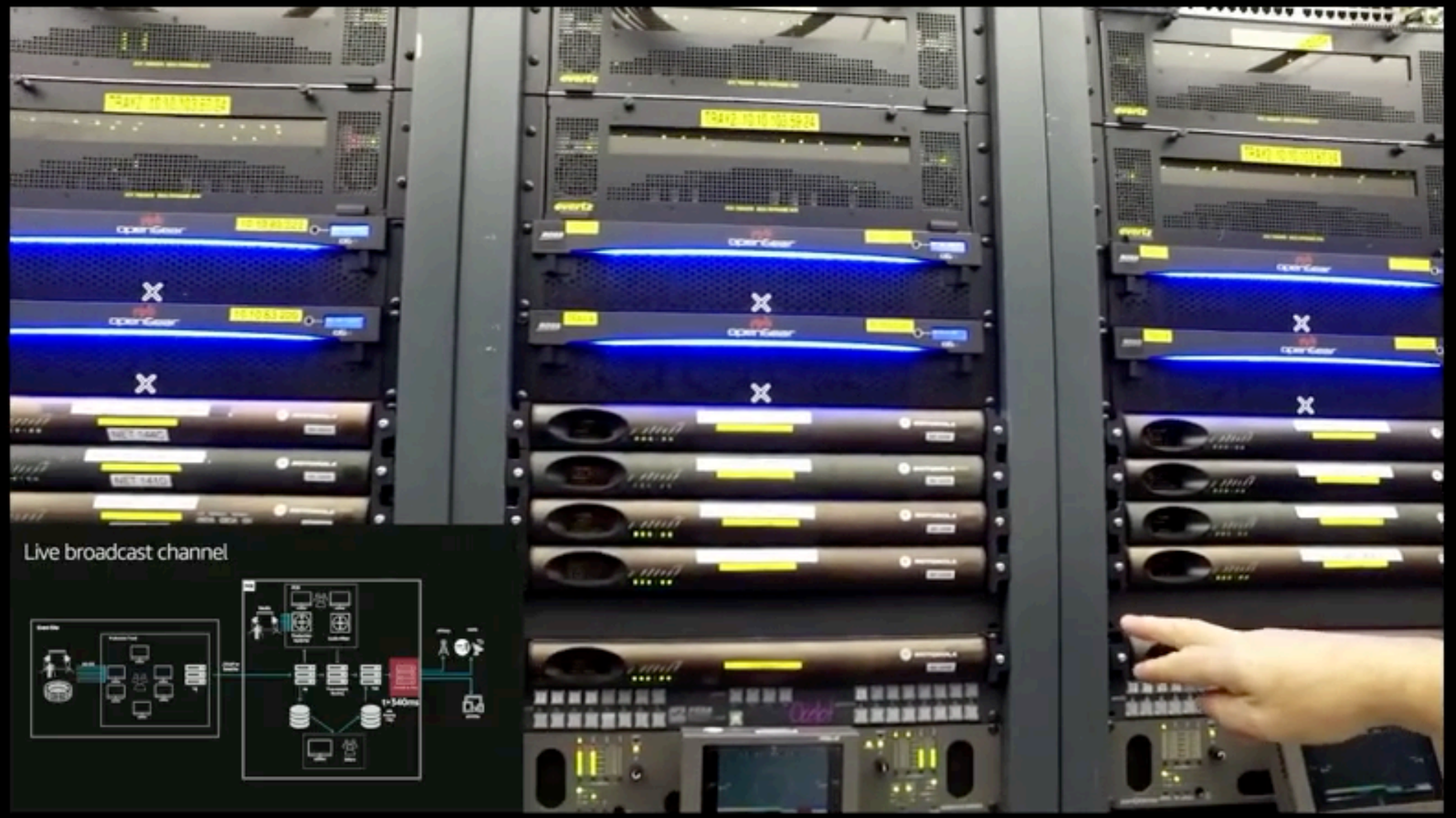






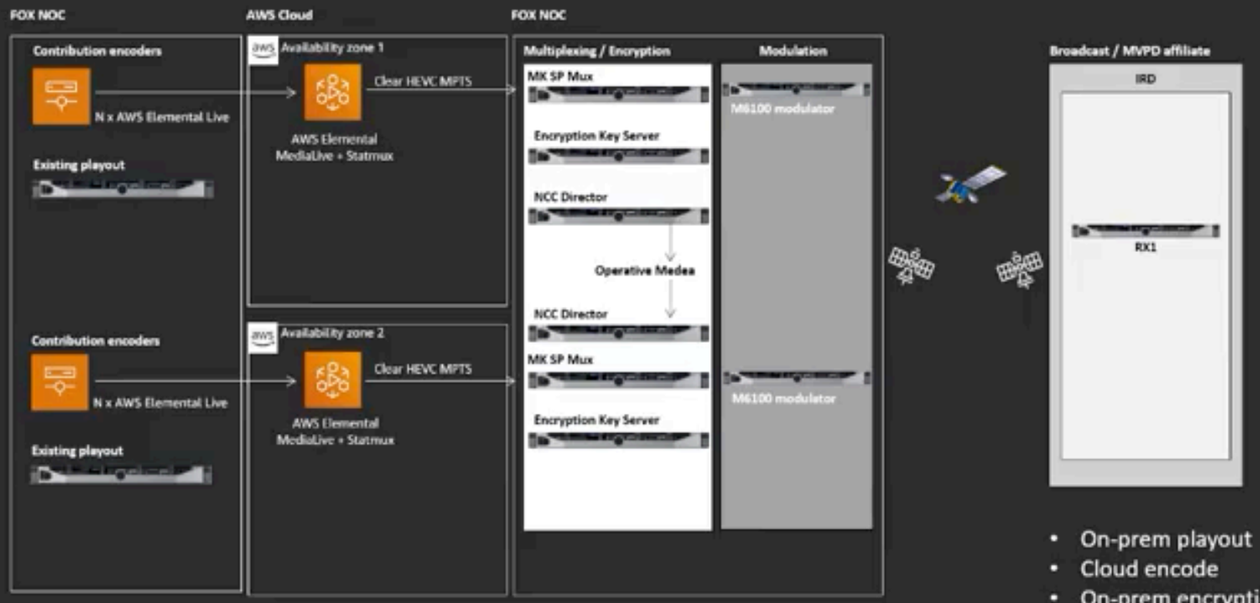

Live broadcast channel




Live broadcast channel

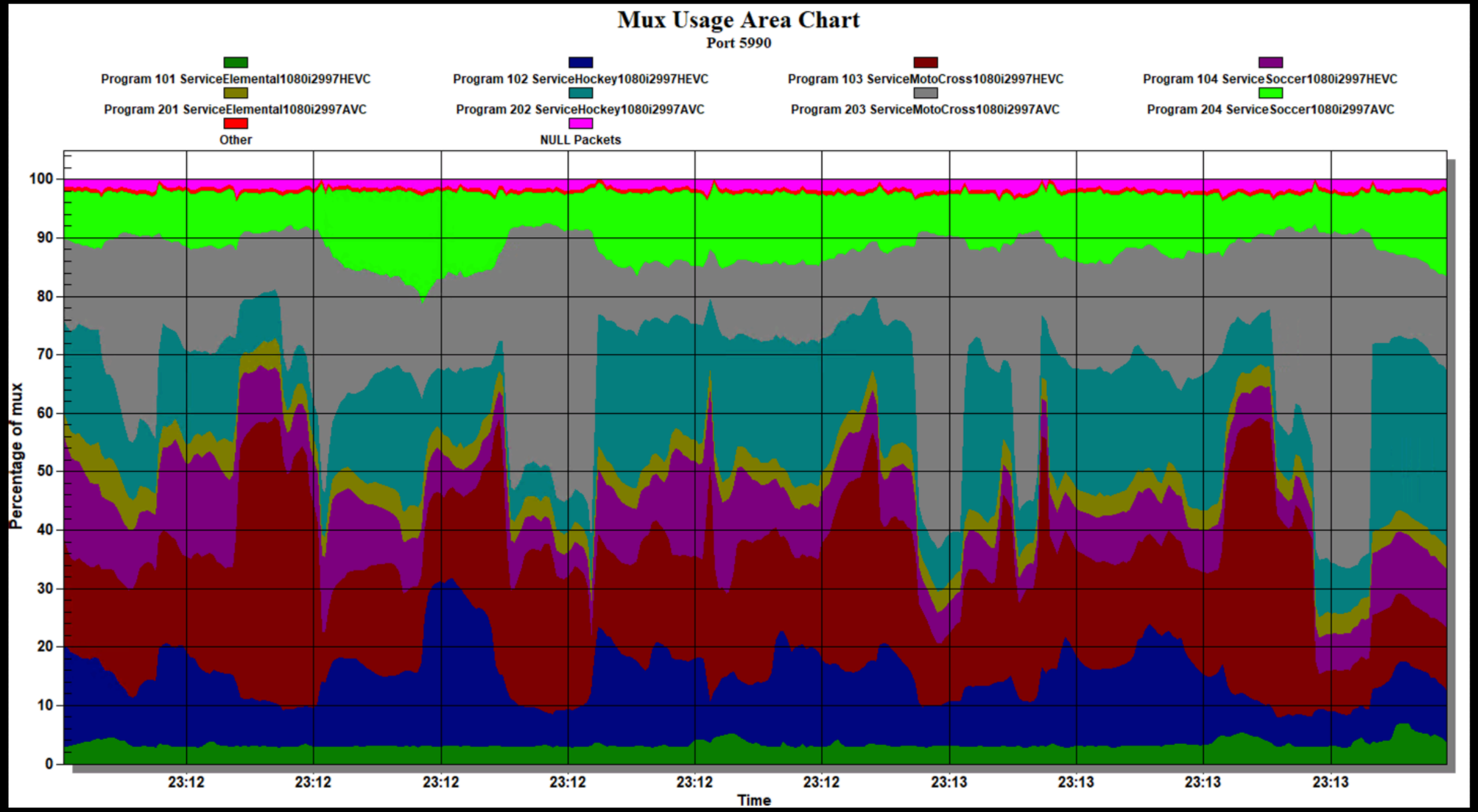


FOX Feb 2020: HEVC + AWS Cloud migration phase I



- On-prem playout
- Cloud encode
- On-prem encryption

Statmux pool graph from TS Analyzer

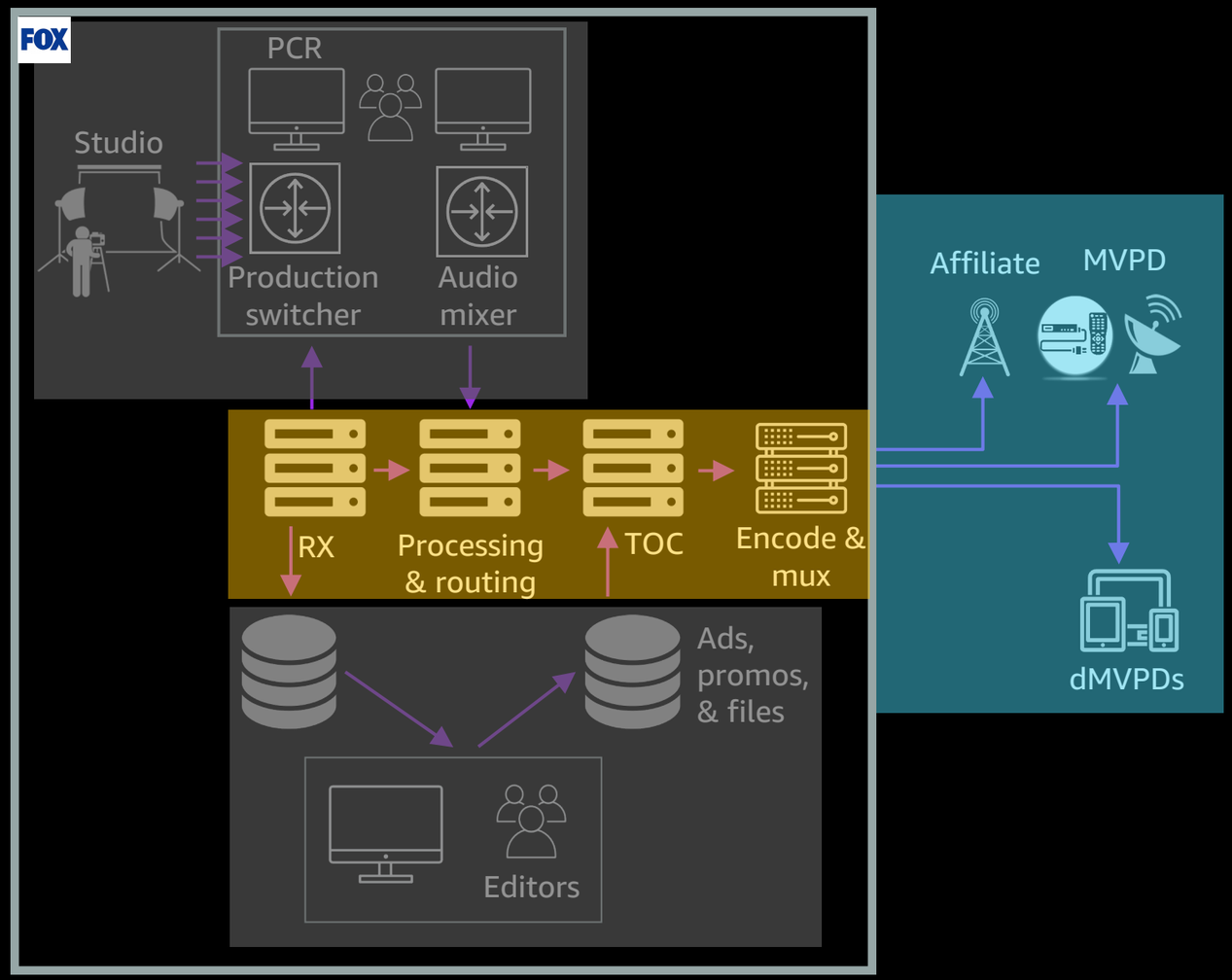


What’s next?

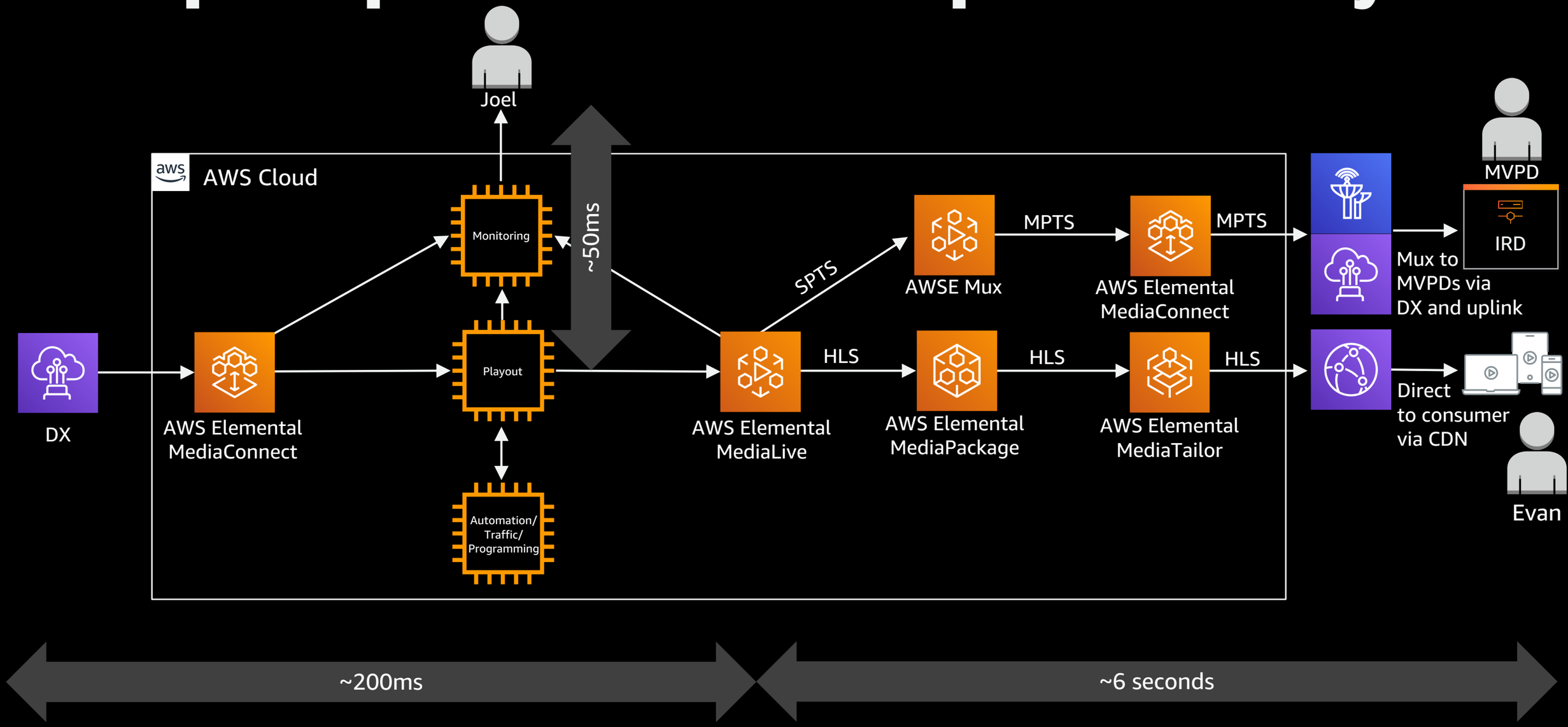
- How can we deliver extreme resiliency and have less reliance on complex broadcast facilities?
- Can we achieve virtually zero latency from the cloud for assembly?
- How can we improve picture quality overall?
- Remove large capital expense cycles of equipment and moves toward more COTS



Area of focus for FOX: Live TV



Live sports production and requisite latency




FOX Sports PCR Distribution
PCR201
PCR201E
PCR202E
PCR203
PCR203E
PCR204
PCR204E
PCR501
PCR501E
NET 102 TX
NET 101 TX
TICKER 102 FILL
TICKER 802 FILL
NET 102 PGM
NET 101 PGM
NET 101 EXT1 Sync
NET 101 EXT2 Sync
PCR 501
PCR 202
TIE 22
TIE 32

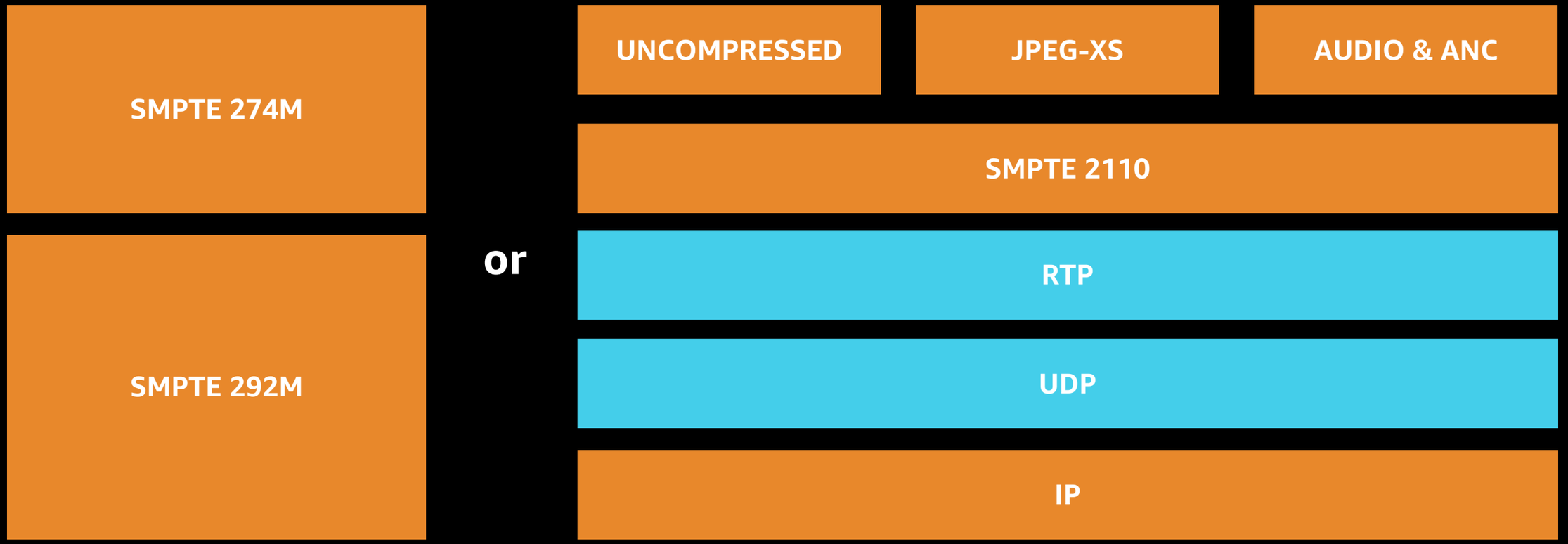
re:Inventing live TV in the cloud



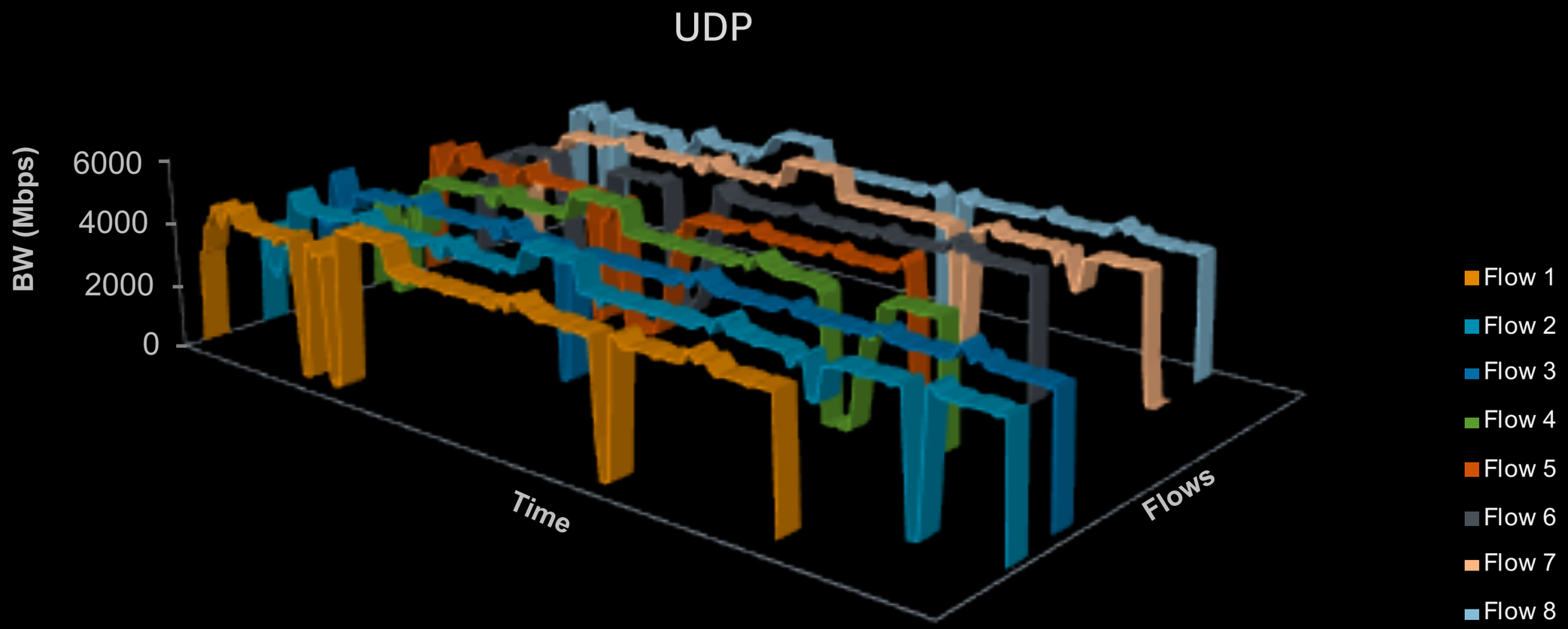
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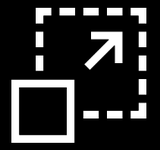
On-premises live production stack



UDP in cloud


UDP
BW (Mbps)
6000
4000
2000
0
Time
Flows
Flow 1
Flow 2
Flow 3
Flow 4
Flow 5
Flow 6
Flow 7
Flow 8

AWS Scalable Reliable Datagram (SRD)



New network transport protocol

Uses many paths through the network instead of just one



Reliable, high-throughput, low-latency transport

Goal is 100% of data delivered between two instances on time

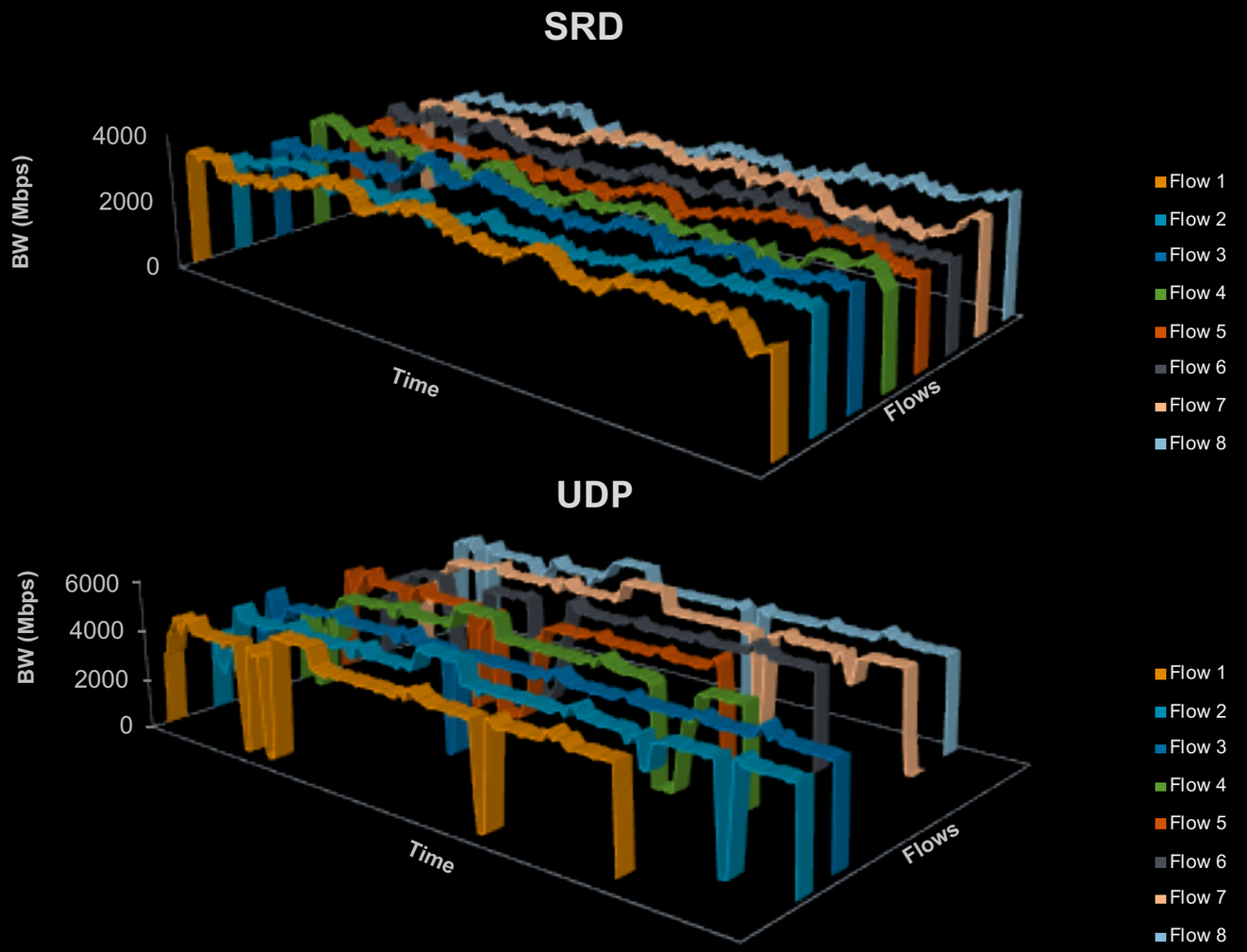


Purpose-designed for AWS datacenter networks

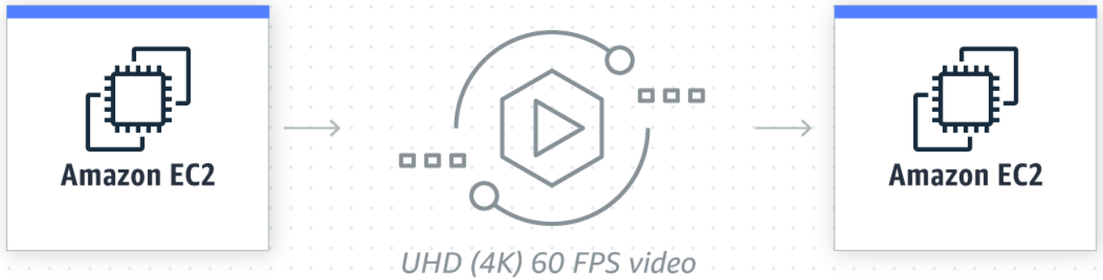
Integrated into Nitro card

Available with Elastic Fabric Adapter

SRD: Congestion control



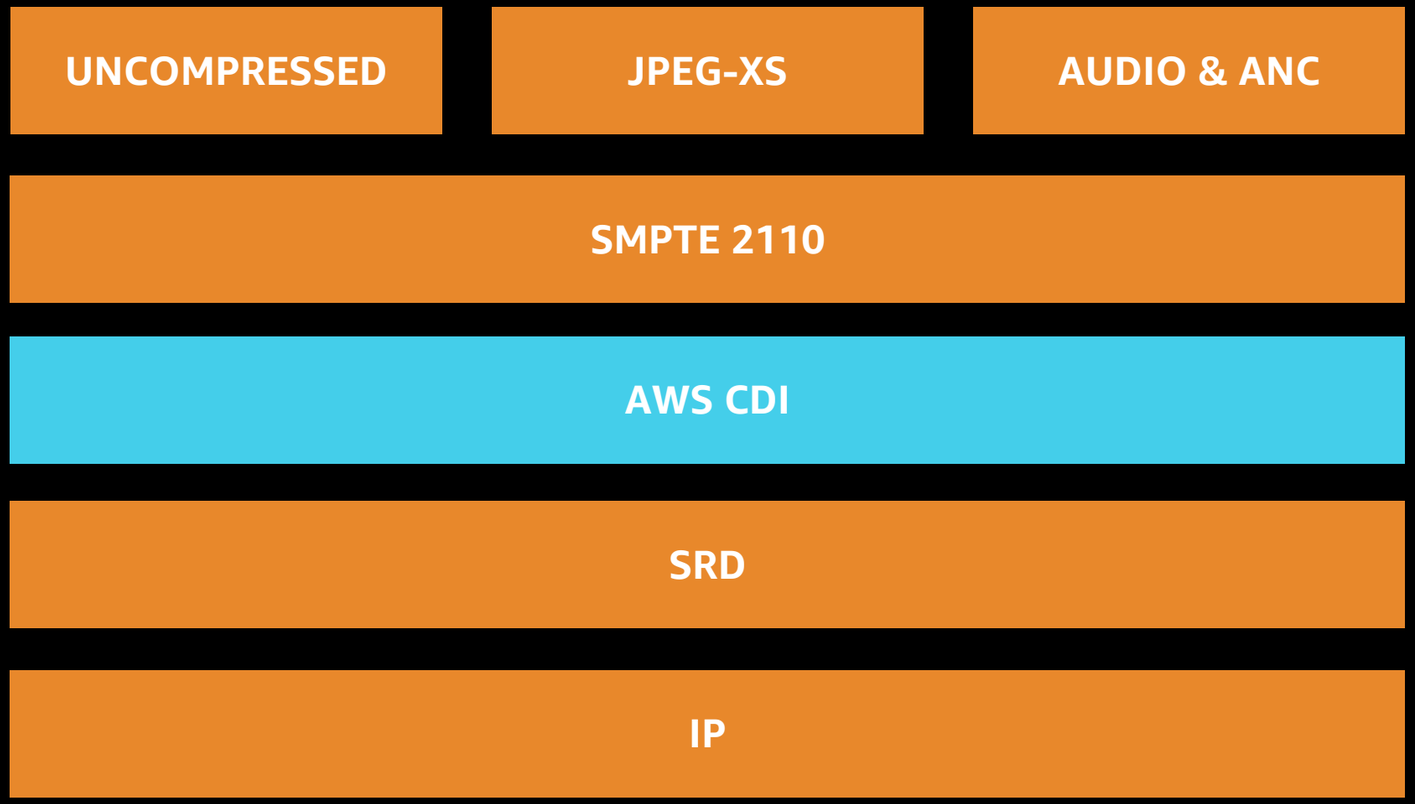
Introducing AWS Cloud Digital Interface (CDI)



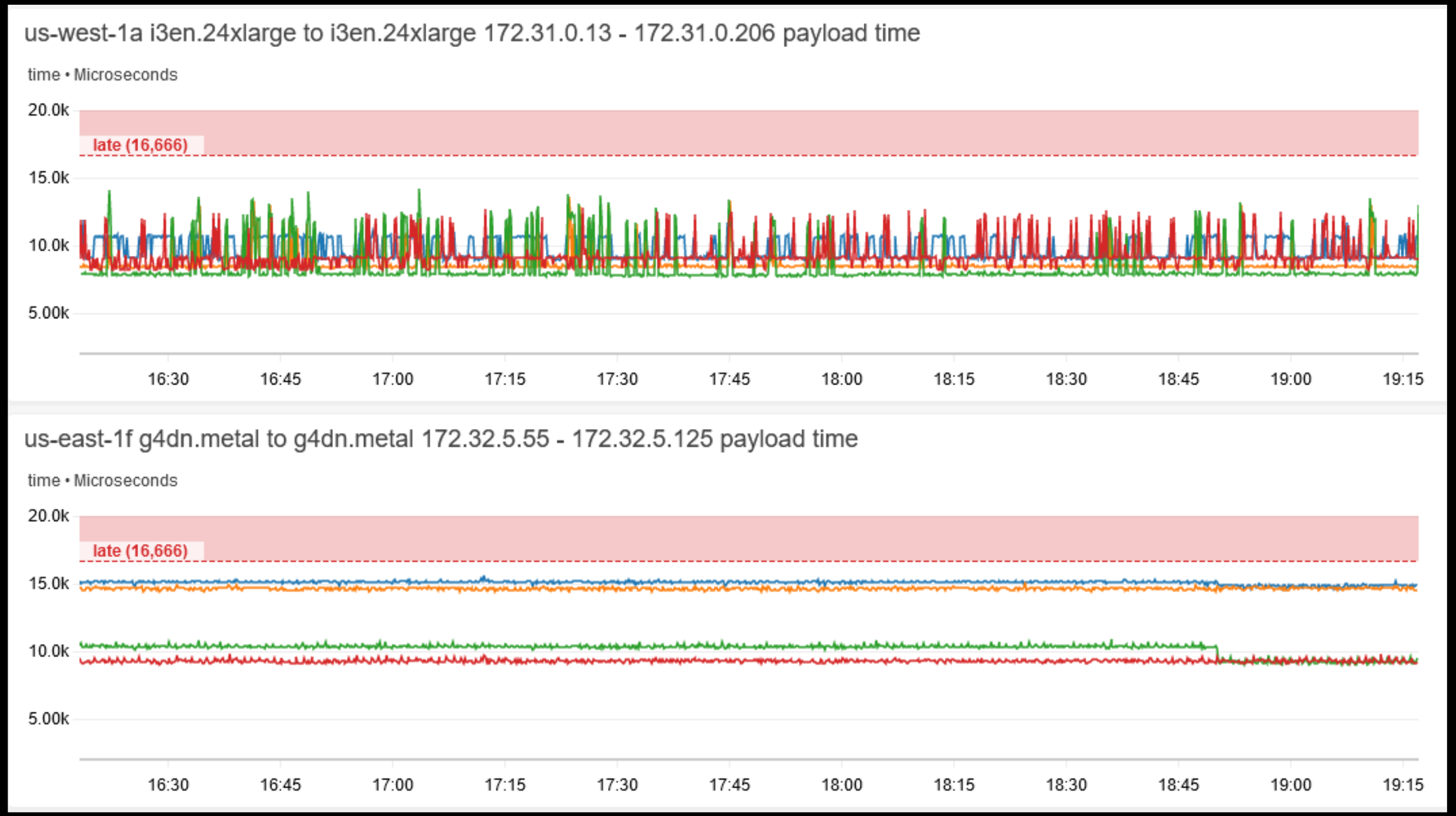
AWS Cloud Digital Interface

Uncompressed live video is transferred in real time between software applications running on Elastic Fabric Adapter (EFA) enabled Amazon EC2 instances.

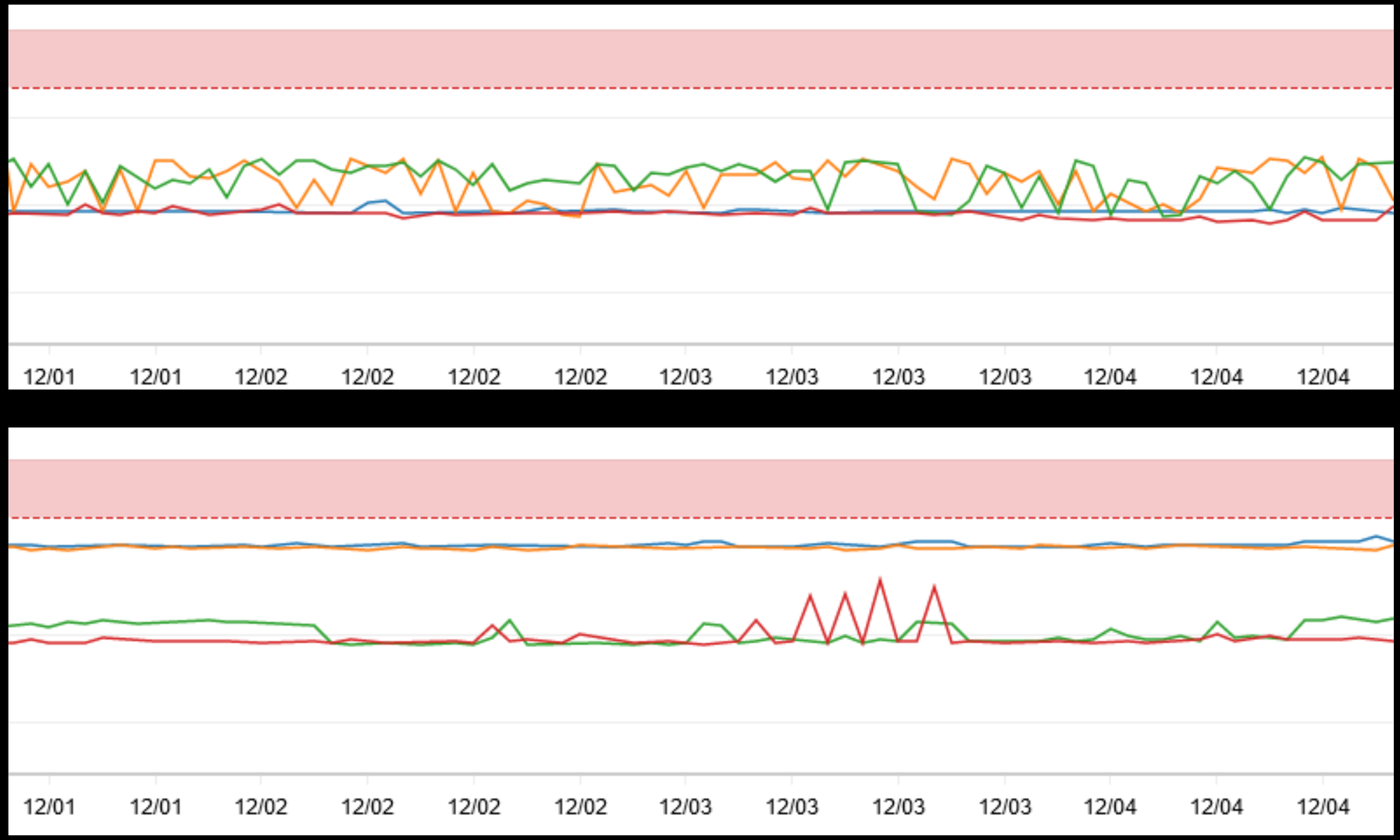
Networking for live production on AWS



CloudWatch statistics: Performance data



CloudWatch statistics: Performance data



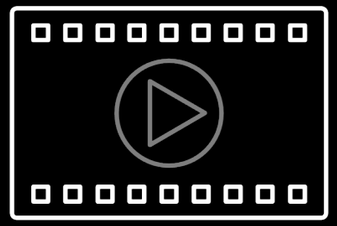
AWS CDI features



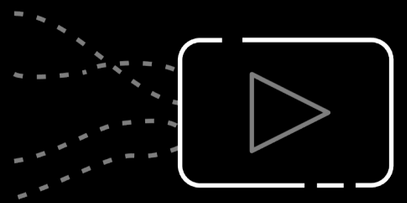
Access and alter pixel data



Supports RGBA for graphic overlays in a single essence



Enables offloading of encoding and decoding from applications



Metadata flows are separate essences within the AWS CDI connection, enabling SCTE104 insertion, live closed captioning, any timed metadata

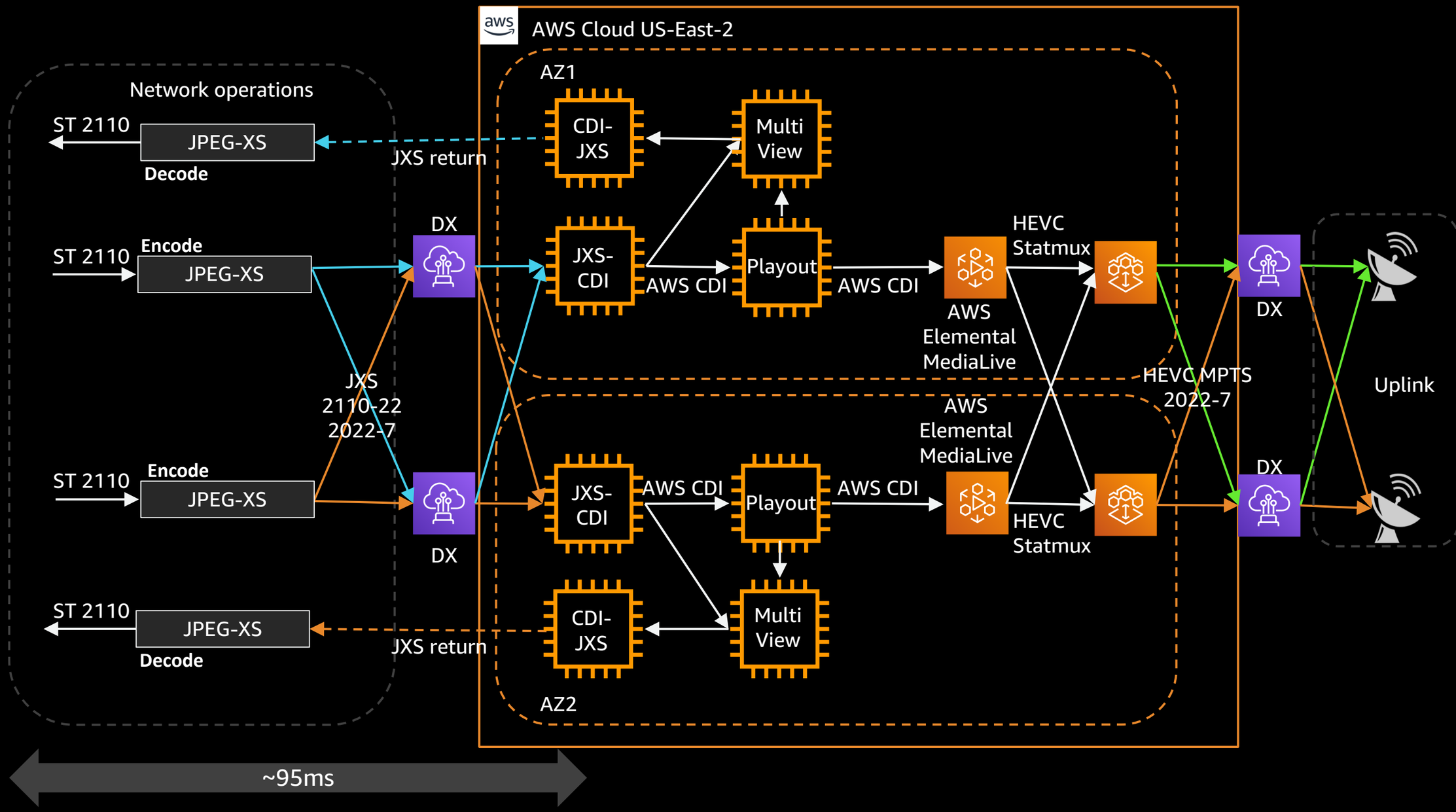
FOX Technology Center



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FOX Technology Center



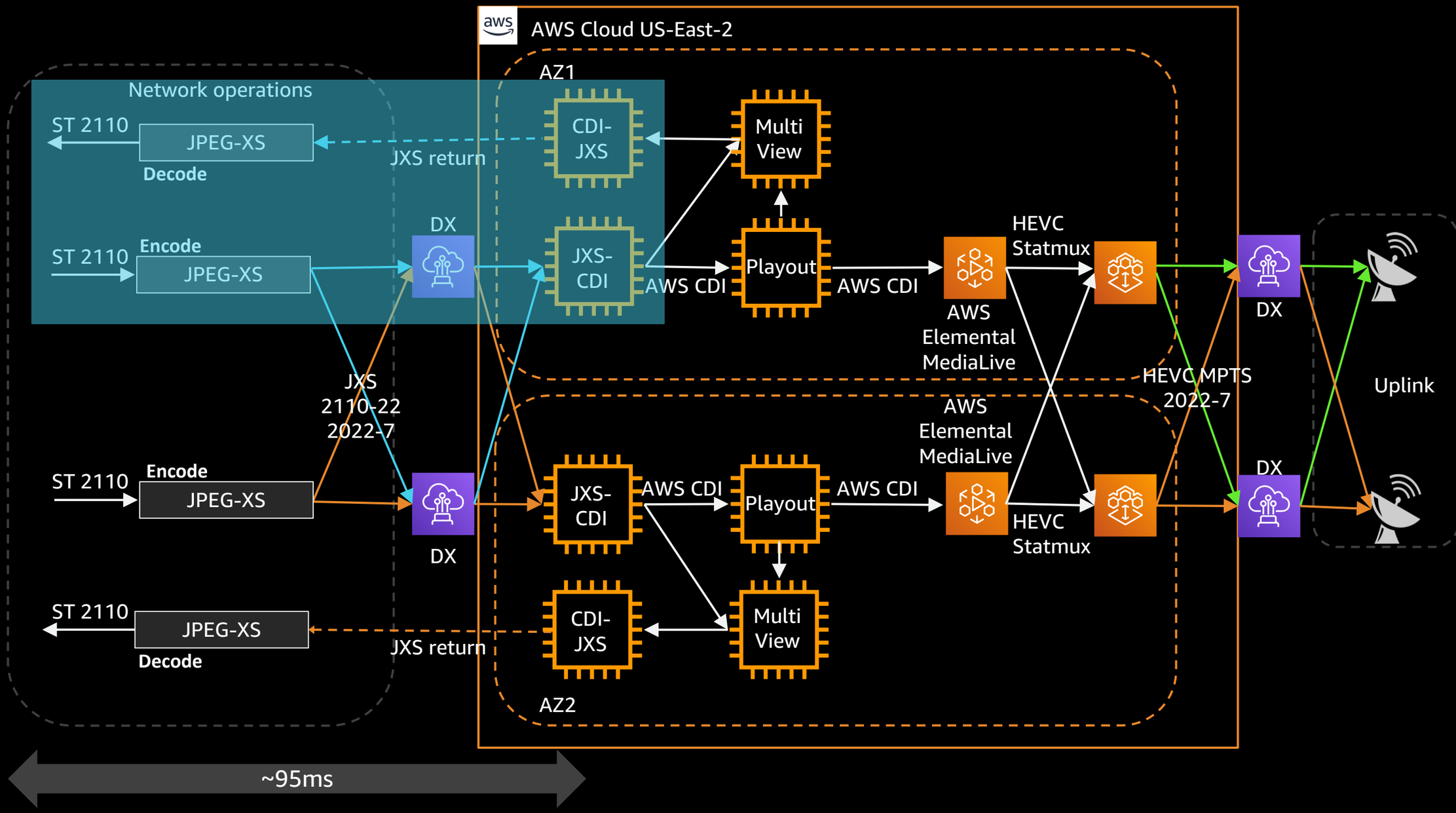
JPEG-XS and AWS CDI latency demonstration

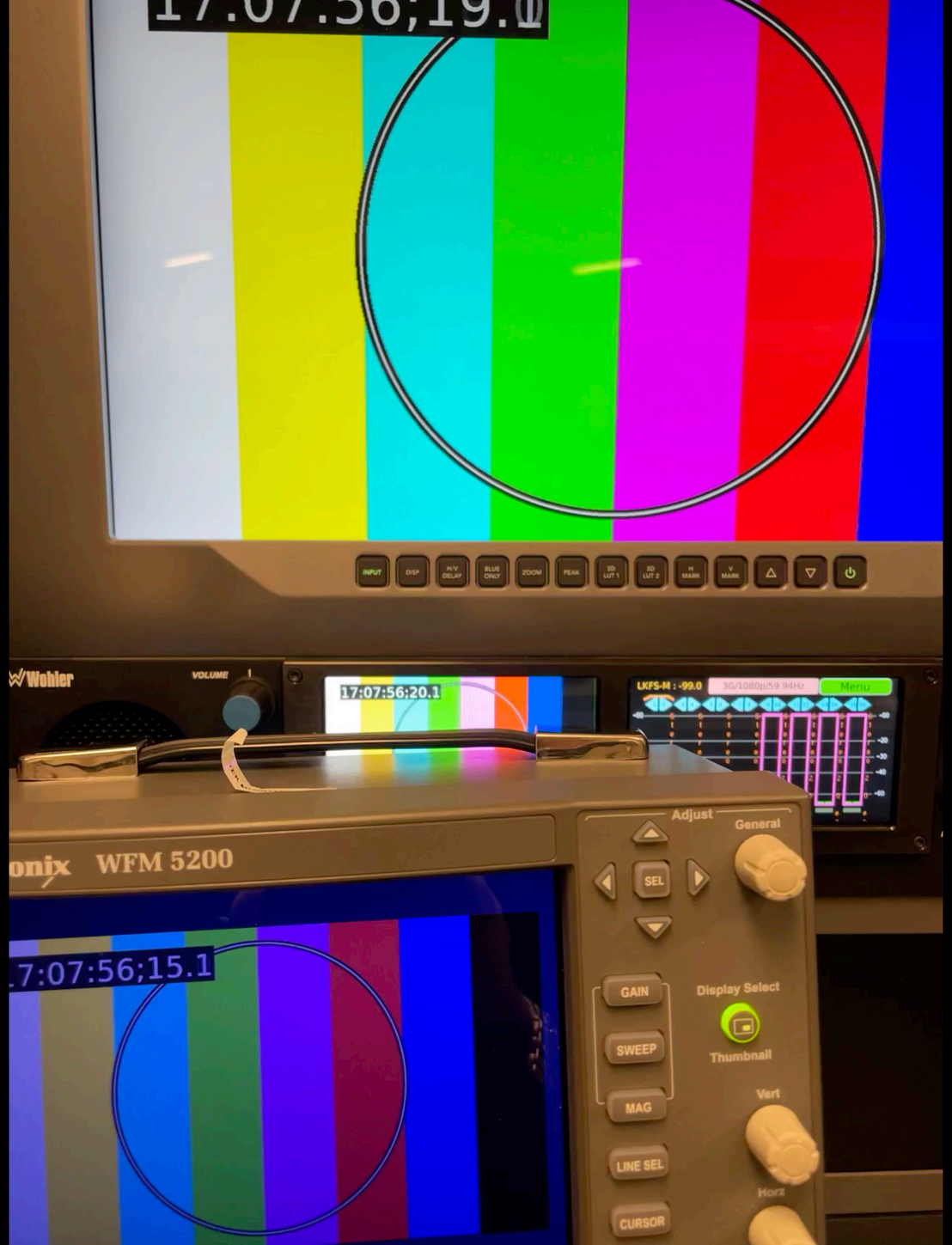


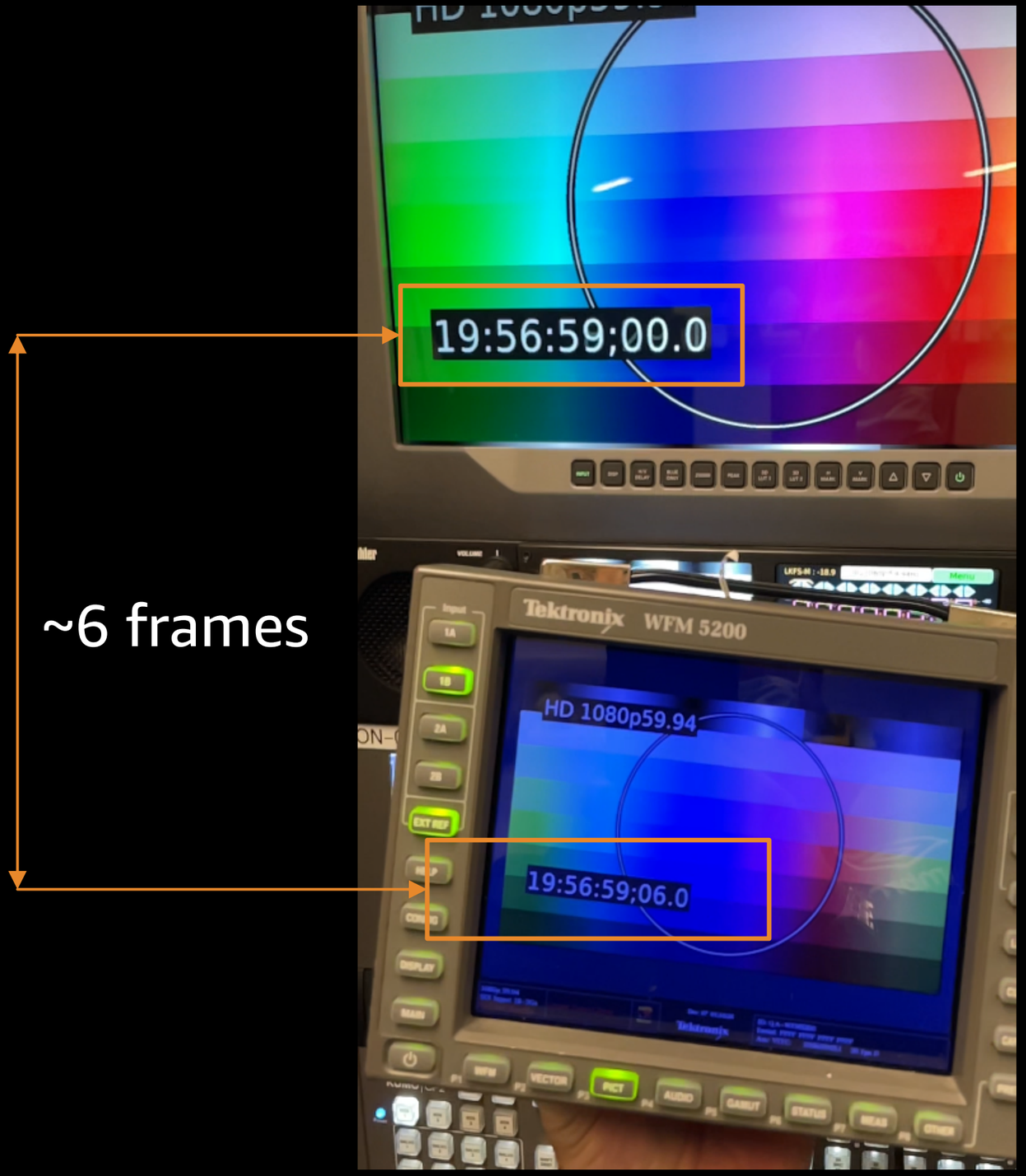
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FOX Technology Center: Production deployment




17:07:56;19.0
INPUT
DISP
H/V DELAY
BLUE ONLY
ZOOM
PEAK
3D LUT 1
3D LUT 2
H MARK
V MARK
Wohler
VOLUME
17:07:56:20.1
LKFS-M : -99.0
Menu
WFM 5200
Adjust
General
SEL
GAIN
SWEEP
MAG
LINE SEL
CURSOR
Display Select
Thumbnail
Vert
Horz


19:56:59;00.0
~6 frames
Tektronix WFM 5200
HD 1080p59.94
19:56:59;06.0

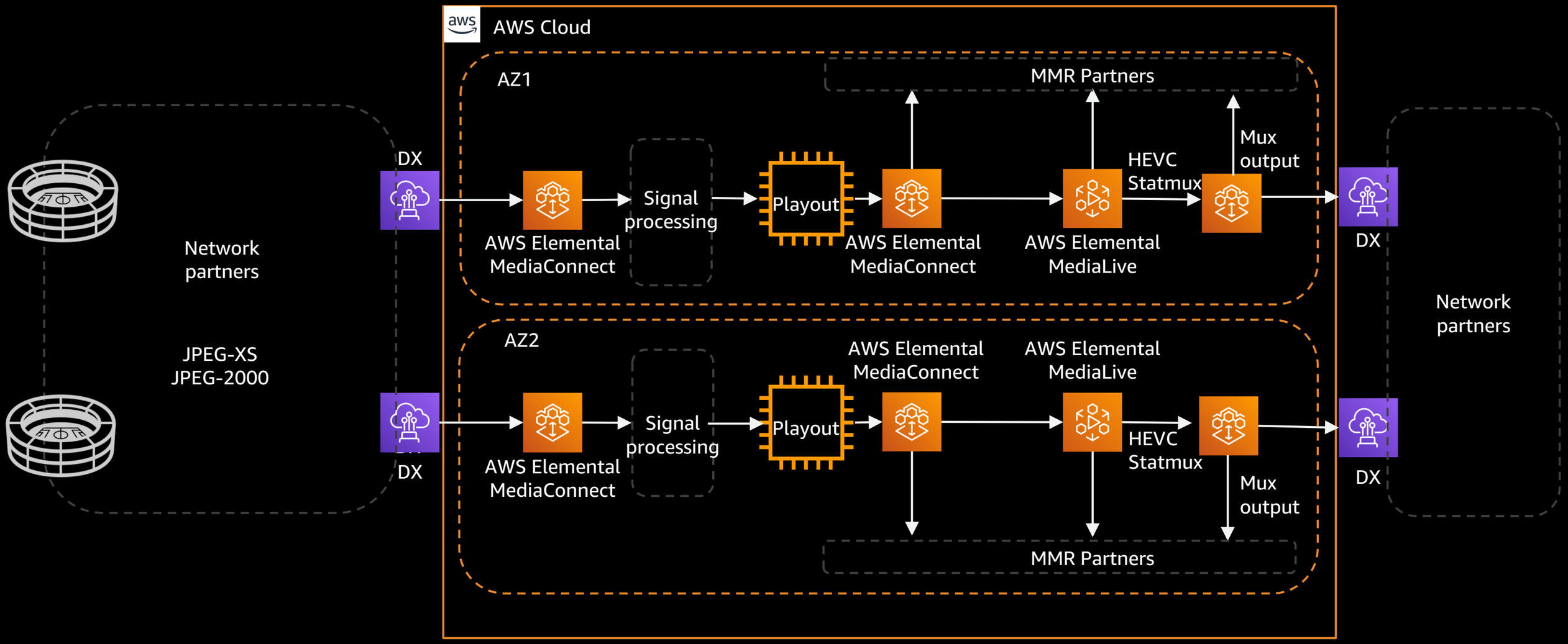
Preview: Next year



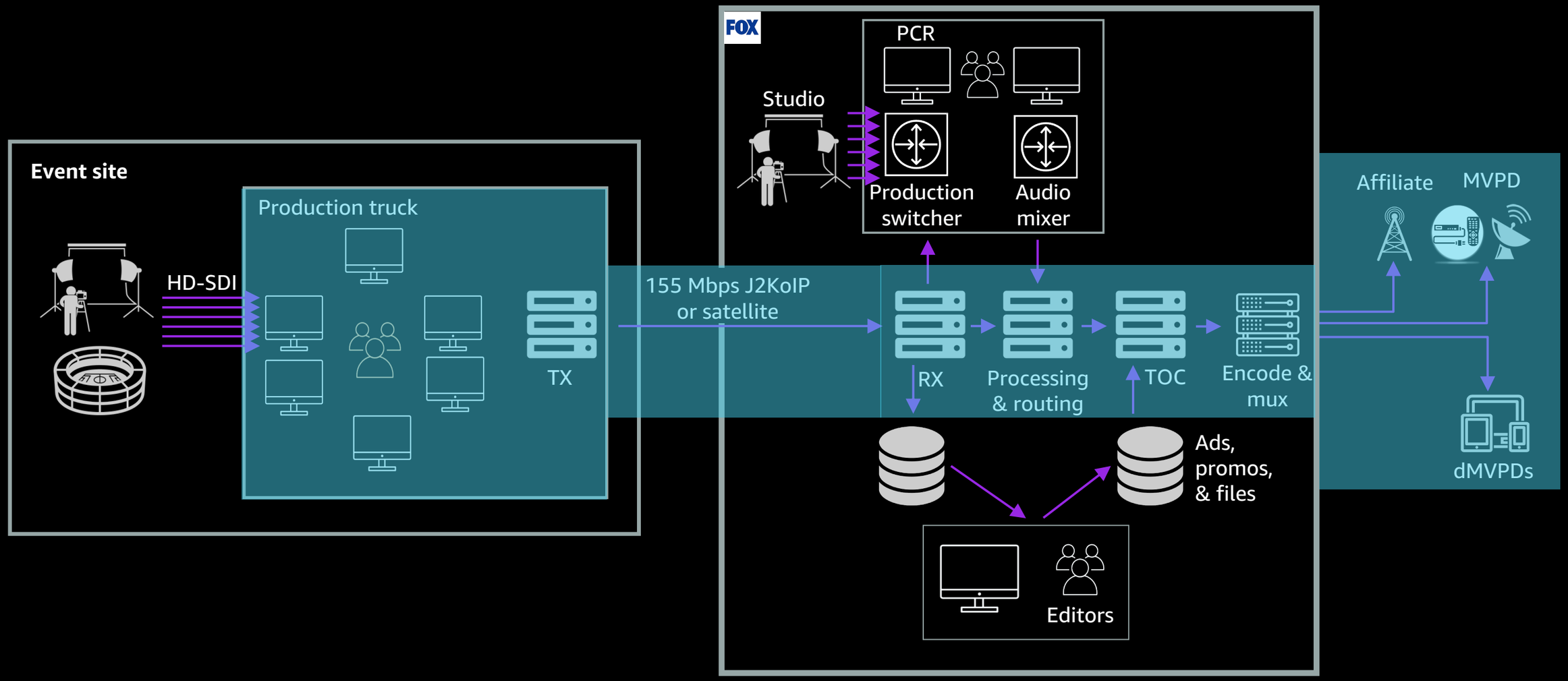
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Stadium connectivity and Meet Me rooms



Area of focus for FOX: Live production



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