AWS
re:Invent

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NET312

HBO Max achieves scale and performance with Amazon CloudFront

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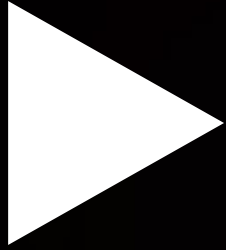Tal Shalom

Principal Product Manager
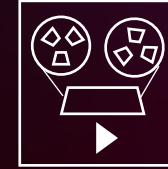CloudFront, AWS

aws

Agenda

- Amazon CloudFront network for a high Quality of Experience

  - Optimize your delivery configuration

  - Test your media delivery settings

  - Live Event and premiere release support

- HBO Max journey with Amazon CloudFront

  - HBO Max multi-CDN traffic management

  - HBO Max House of the Dragon ready for scale

  - HBO Max - what's next?

60 years of the Play button...

1960's

1980's

1990's

2000's

2020's

The user Quality of Experience factors

- Video Start Success rate
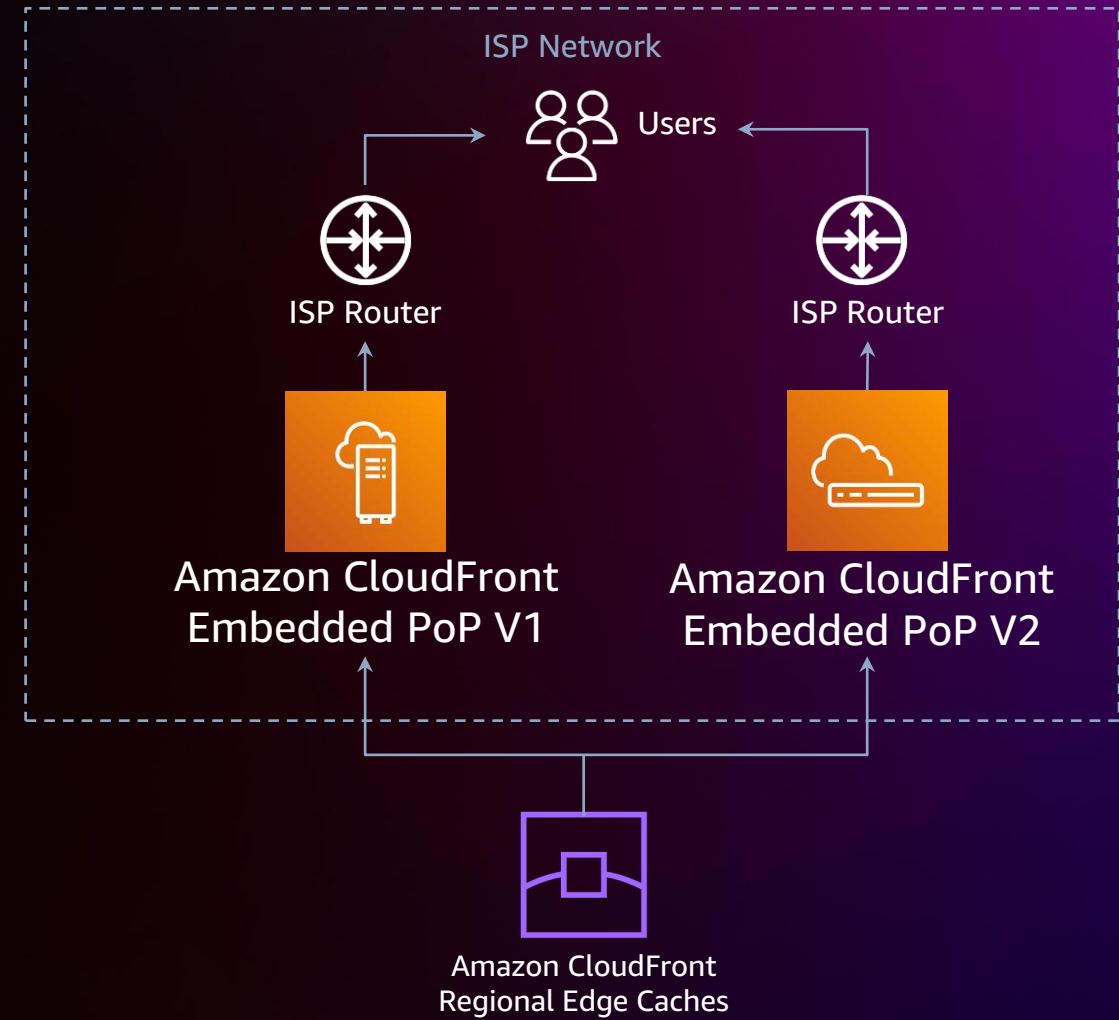- Continuous Video Play Success Rate
- Player Buffer rate Errors

Global edge locations
Amazon CloudFront has over
450 points of presence,
13 regional edge caches across
90+ cities in 48 countries

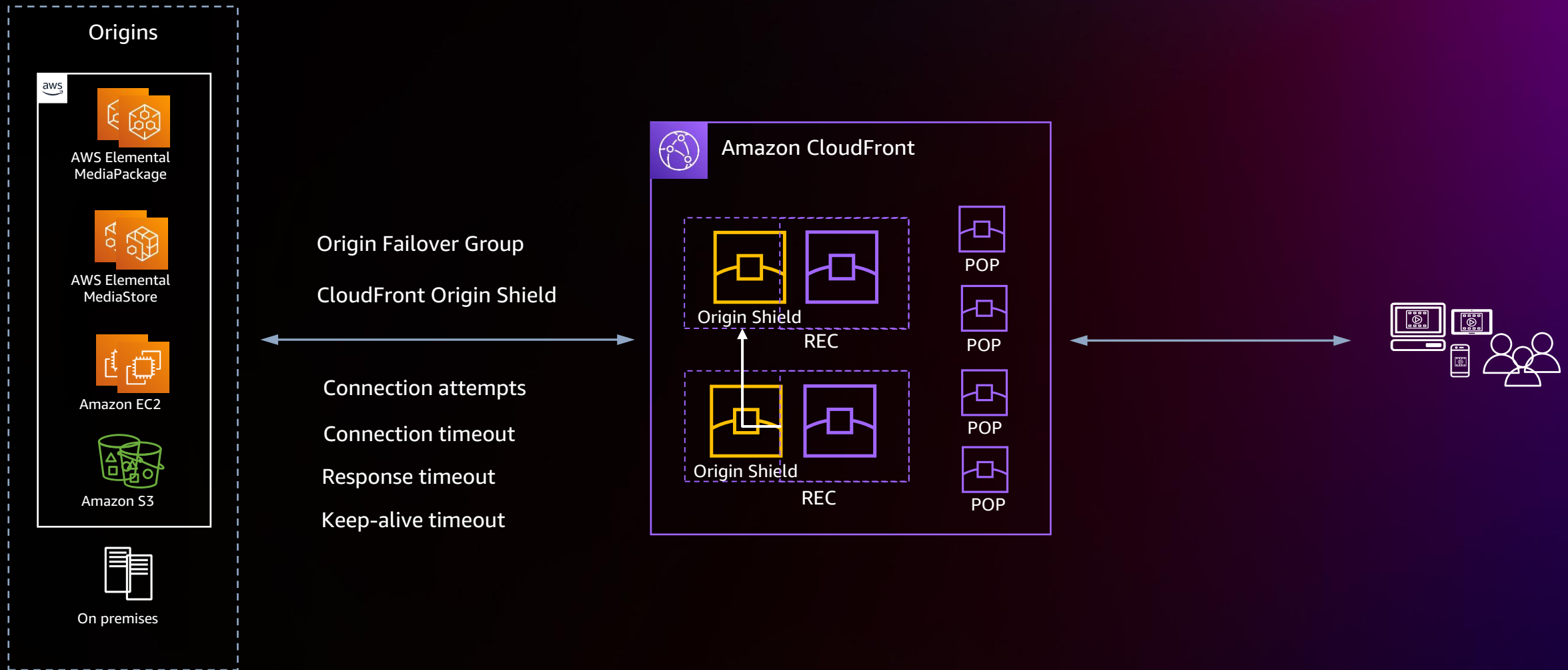# Closer to your viewers with embedded PoP V2

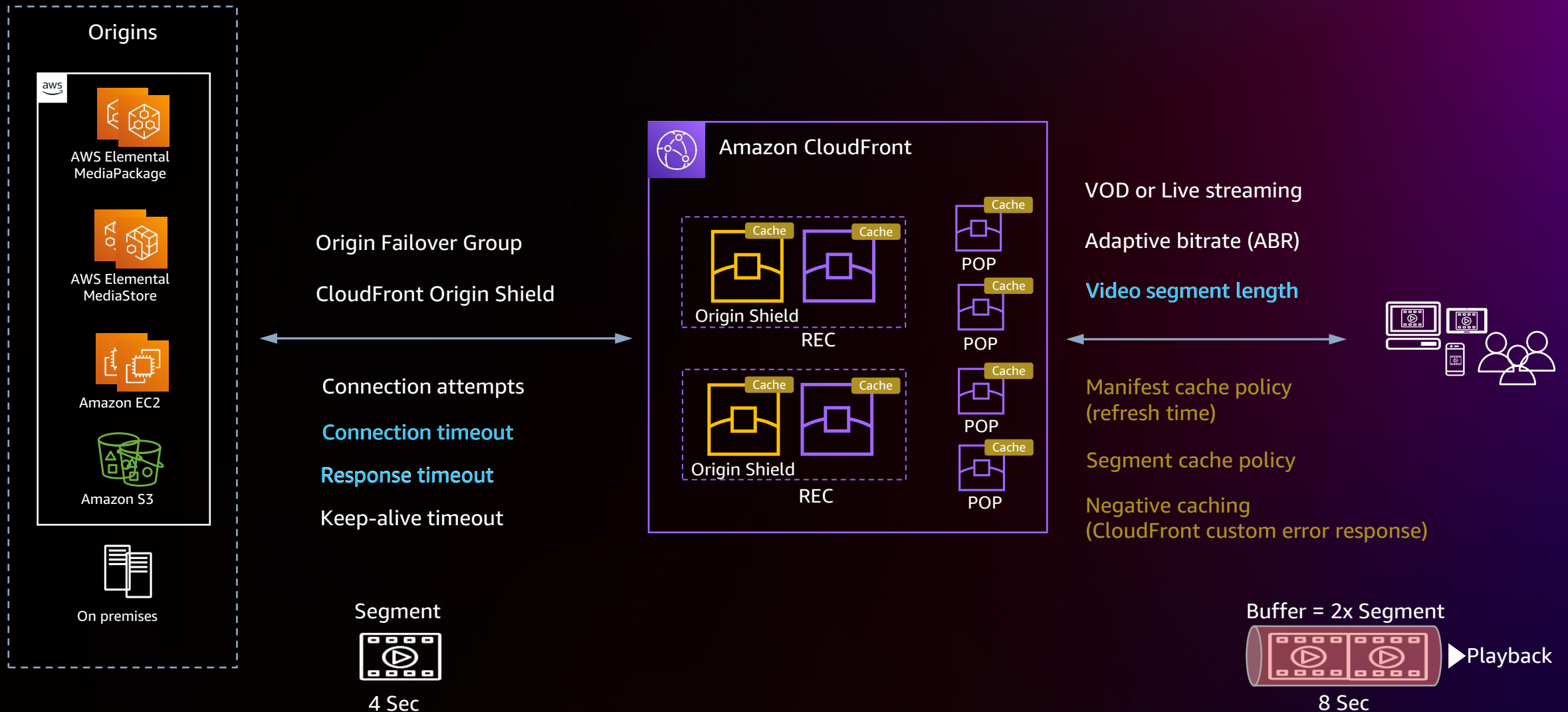- Increased Scale
  - Launched 220+ CloudFront Embedded PoPs V2
- Improved Performance
  - Improvement in First Byte Latency
- Improved traffic offload
  - Extended footprint across ISPs
  - Peak traffic live streaming, game download, popular VOD

ISP Network

Users

ISP Router

ISP Router

Amazon CloudFront
Embedded PoP V1

Amazon CloudFront
Embedded PoP V2

Amazon CloudFront
Regional Edge Caches

Configure for end-to-end high availability

Origins

aws
- AWS Elemental MediaPackage
- AWS Elemental MediaStore
- Amazon EC2
- Amazon S3

On premises

Origin Failover Group

CloudFront Origin Shield

Connection attempts
Connection timeout
Response timeout
Keep-alive timeout

Amazon CloudFront

Origin Shield
REC

Origin Shield
REC

POP
POP
POP
POP

Optimize delivery for high quality of experience

Origins

AWS Elemental MediaPackage

AWS Elemental MediaStore

Amazon EC2

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On premises

Origin Failover Group

CloudFront Origin Shield

Connection attempts

Connection timeout

Response timeout

Keep-alive timeout

Segment

4 Sec

Amazon CloudFront

Cache

Cache

Origin Shield

REC

Cache

Cache

Origin Shield

REC

Cache

POP

Cache

POP

Cache

POP

Cache

POP

VOD or Live streaming

Adaptive bitrate (ABR)

Video segment length

Manifest cache policy (refresh time)

Segment cache policy

Negative caching (CloudFront custom error response)
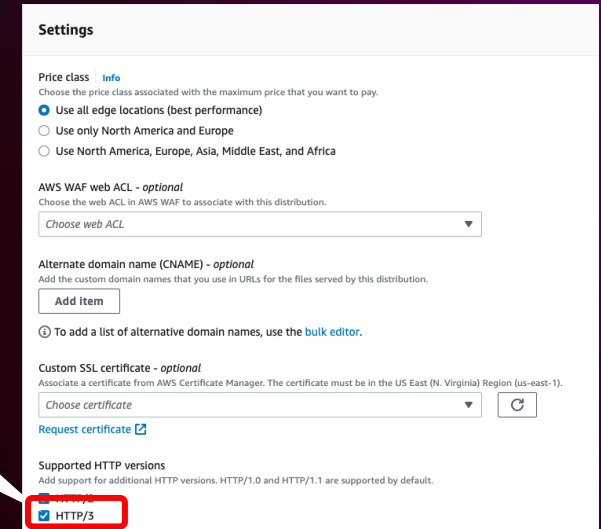
Buffer = 2x Segment

Playback

8 Sec

Lower latency streaming over HTTP/3 and QUIC

- HTTP/3 – the third major version of the HTTP standard

- Uses Quick UDP Internet Connections (QUIC) transport protocol
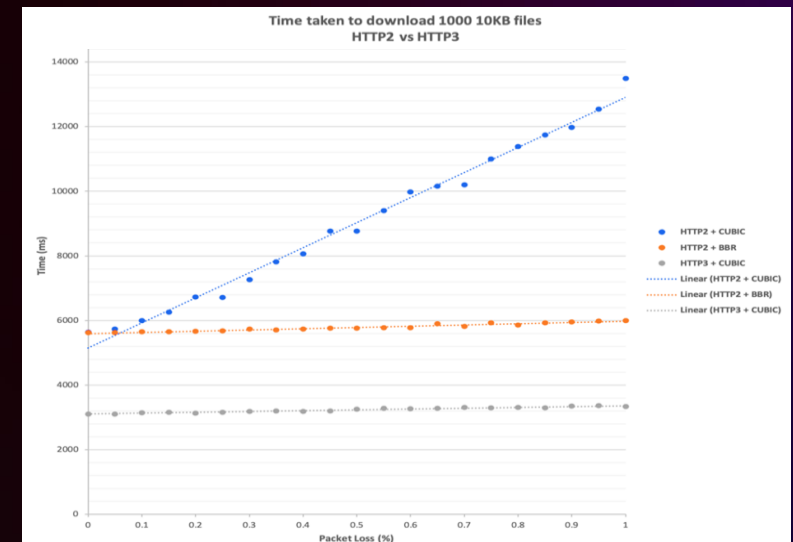
Performance benefits:

- Faster connection setup (Lower latency)

- Improved packet loss recovery (less re-buffer)

- Multiplexed streams

- Connection migration (Video streaming on the go)

- Encrypted – TLS 1.3

Enable HTTP/3 in your CloudFront Distribution Settings

Edge compute for media delivery workflows

Lambda@Edge
For complex, longer running functions

- **Streaming manifest manipulation**
  - Insert ads into a manifest or secure streams by adding security tokens to segments creating a personalize manifest for each viewer

- **Invoke transcoding jobs**
  - Call AWS Elemental MediaConvert API to initiate a transcoding job

- **Send client side player metrics to traffic analysis system**
  - Parse client side metrics from request headers or query strings and send to traffic logging/analysis system
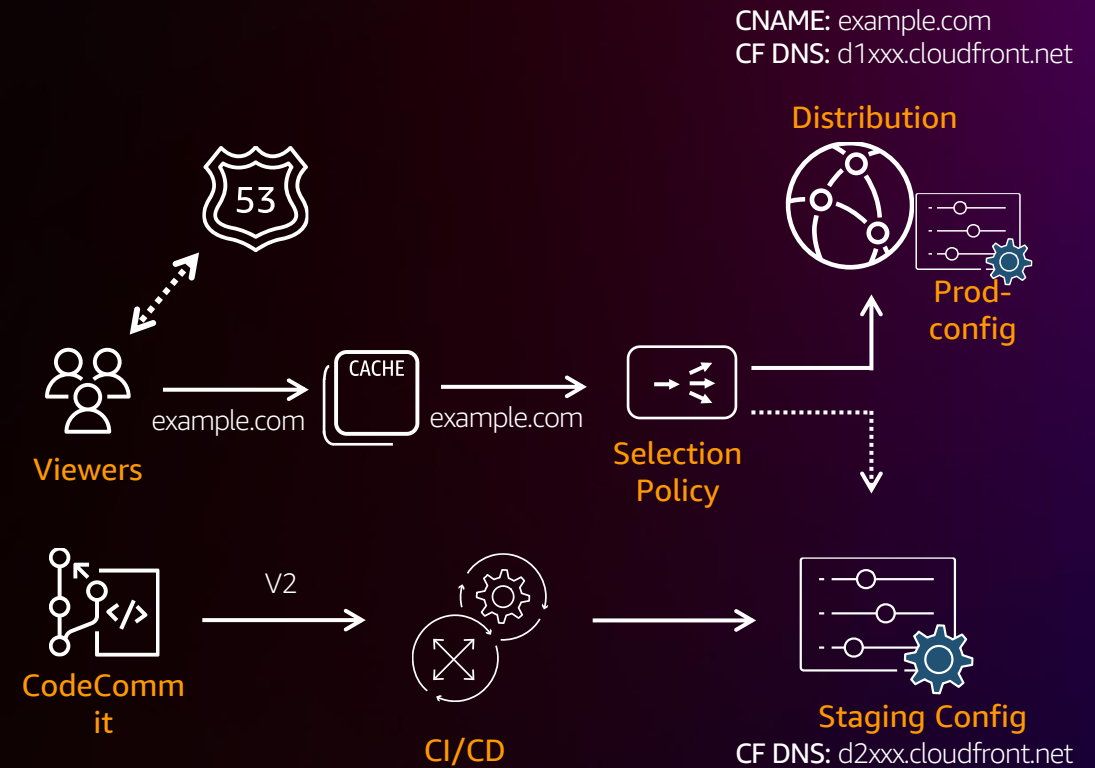
CloudFront Functions
For latency-sensitive functions

- **Viewer request token validation**
  - Validate access token based on claims correlated to request parameters and expiry

- **Obfuscate content URL (rewrite)**
  - Rewrite URL to correlate viewers to specific content, and hide actual url to origin

- **HTTP header manipulation based on content type**
  - Configure security headers, CORS etc. to be sent downstream

- **Redirects at the edge**
  - Manage large volume of HTTP 301/302 responses to provide operational simplicity
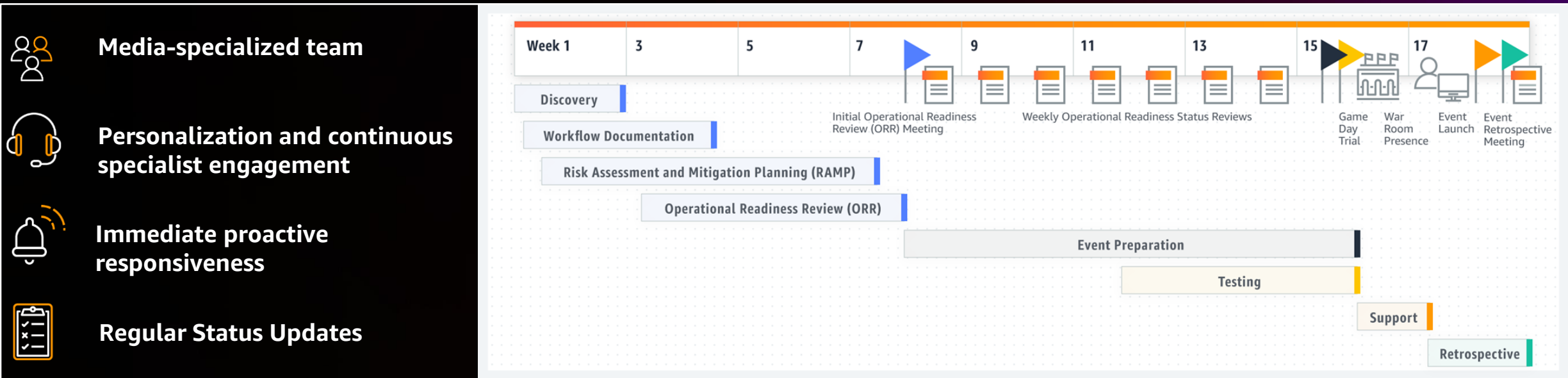
Test your configuration for optimal delivery

- Use production CNAME and/or CloudFront DNS name (dname) to route requests to staging.

- Rules to split traffic: e.g. header, client IP or % traffic

- Promote staging distribution to production – no severed viewer connection, no changes to DNS, no loss of cache

- View & compare same reports and metrics using CloudWatch. Metrics include error rates, latency, and traffic split.

Continuous deployment on Amazon CloudFront

CNAME: example.com
CF DNS: d1xxx.cloudfront.net

Distribution

Prod-config

Viewers

example.com

CACHE

example.com

Selection Policy

CodeCommit

V2

CI/CD

Staging Config
CF DNS: d2xxx.cloudfront.net

Non-routable configuration:
Not known to the routing-plane but known to the Caching data plane

Live events and premieres release support

- Large scale live streaming events (100K+ concurrent viewers - e.g., Super Bowl)
- Multi-day live events or event series (e.g., Sports Seasons or Olympics)
- High-visibility VOD/OTT launches or premieres
- Major 24x7 channel launches

Media-specialized team

Personalization and continuous specialist engagement

Immediate proactive responsiveness

Regular Status Updates

Learn more: https://aws.amazon.com/media-services/resources/mem/
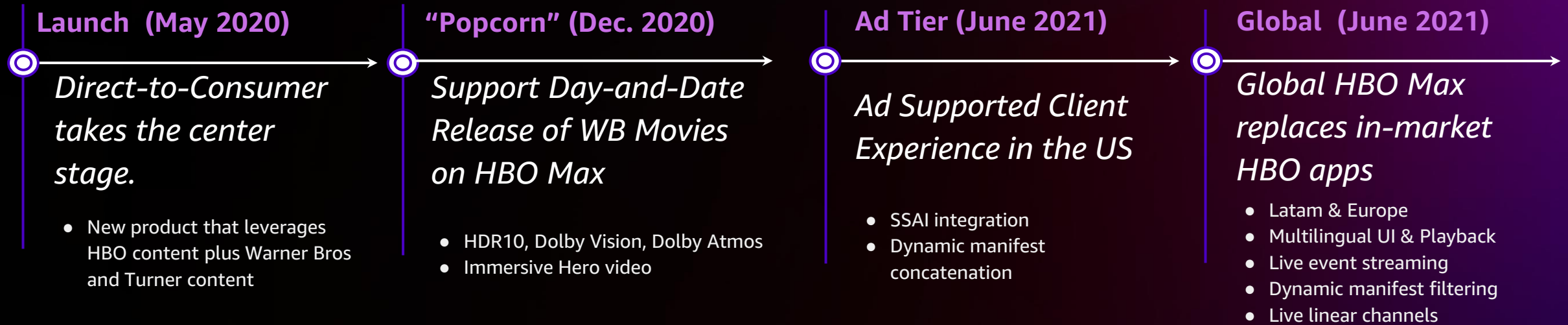
Welcome back HBO Max team

- Amazon CloudFront network for a high Quality of Experience

  - Optimize your delivery configuration

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  - HBO Max – what's next?

One of the leading streaming services

- Premium User Experience
- 94.9M subscribers
  (Q3 2022 - combined HBO/HBO Max & discovery+)
- Ad-supported and Ad-free tiers
- 61 countries
- VOD & Live Streaming
- More than 13,000 hours of programming

HBO Max – From launch to leader

Launch (May 2020)

Direct-to-Consumer takes the center stage.

- New product that leverages HBO content plus Warner Bros and Turner content

"Popcorn" (Dec. 2020)

Support Day-and-Date Release of WB Movies on HBO Max

- HDR10, Dolby Vision, Dolby Atmos
- Immersive Hero video

Ad Tier (June 2021)

Ad Supported Client Experience in the US

- SSAI integration
- Dynamic manifest concatenation

Global (June 2021)

Global HBO Max replaces in-market HBO apps

- Latam & Europe
- Multilingual UI & Playback
- Live event streaming
- Dynamic manifest filtering
- Live linear channels

This rapid product growth and expansion required a resilient and extensible CDN strategy . . .

HBO Max – Content delivery at scale

Multi-CDN strategy

- Spikey traffic

- Accelerated subscriber growth

- Continued global expansion efforts

Why Amazon CloudFront?

- Global footprint

- Increased / necessary capacity

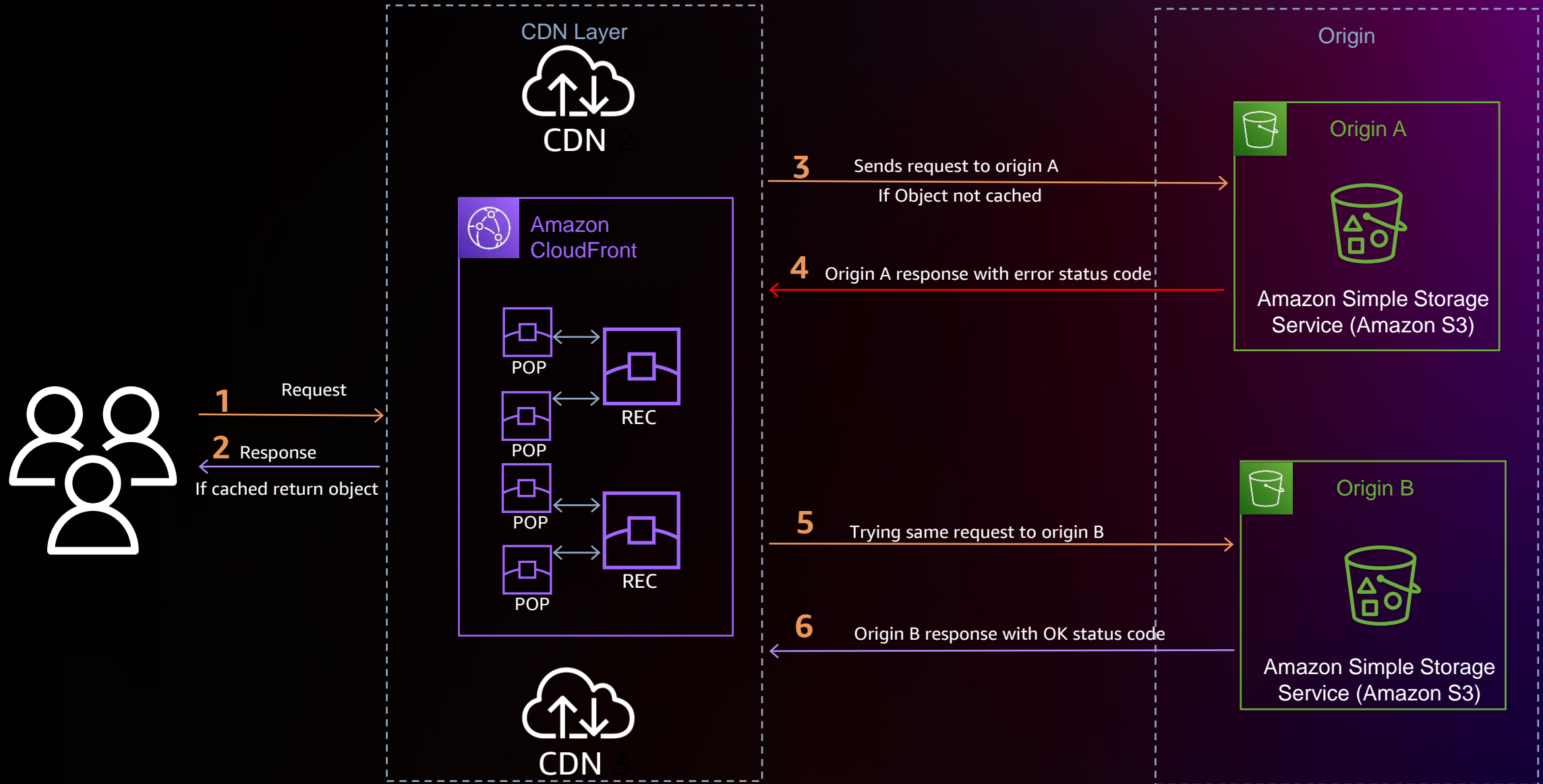- Premium support / operational excellence

Amazon CloudFront is a strategic partner

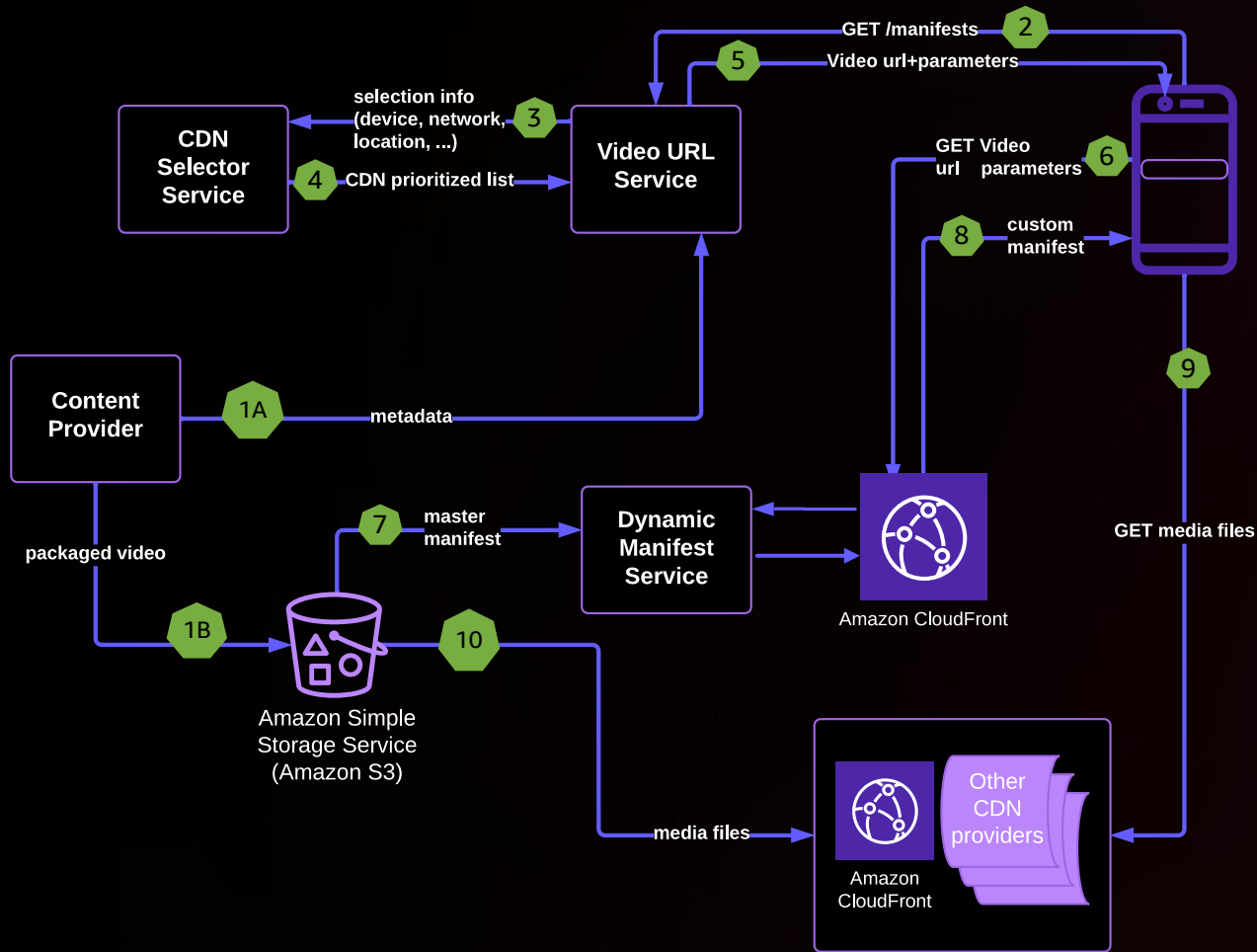- Grown to become one of the top performing CDNs used by HBO Max

HBO Max global content delivery network

HBO Max video delivery

Ensure a premium user experience
- Device capabilities
- CDN selection
- User network

Dynamic Manifests
- Master manifest with all DRM, codecs, bitrates and languages
- Customized manifest for each user request
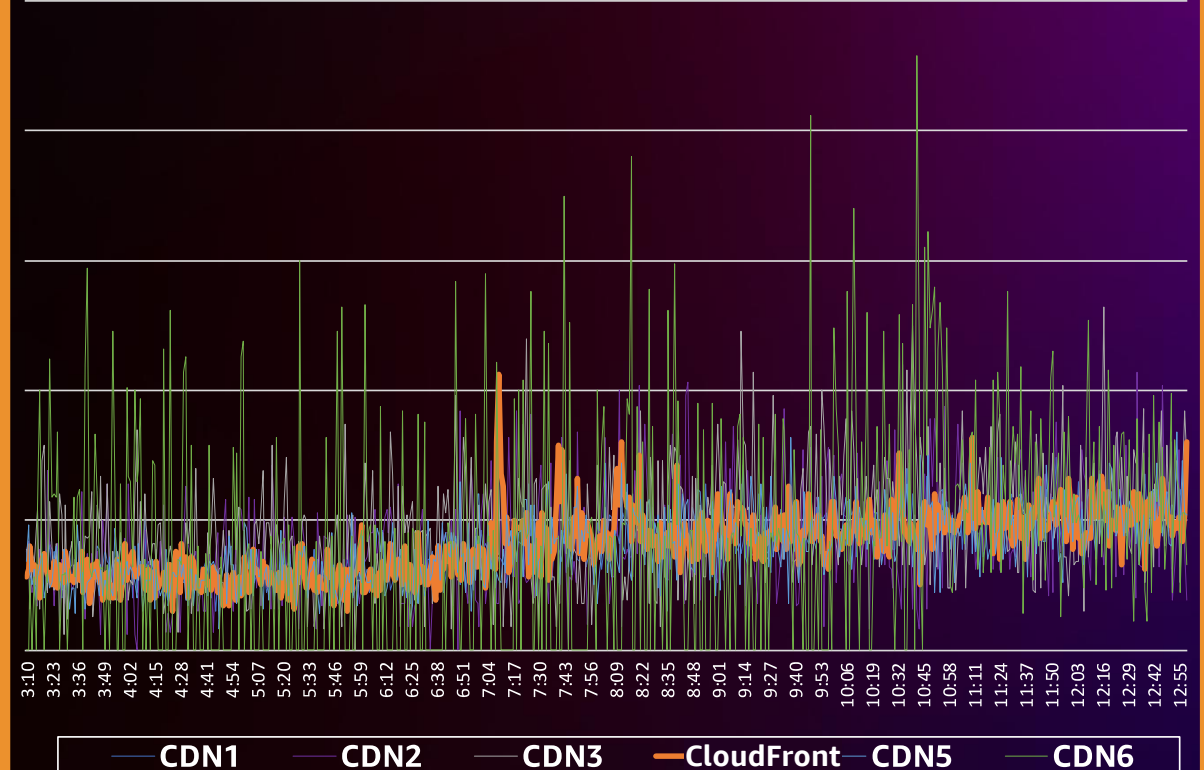
Amazon CloudFront dynamic manifest fronting
- 97+% cache hit

Performance & resiliency strategy – QoE KPI's
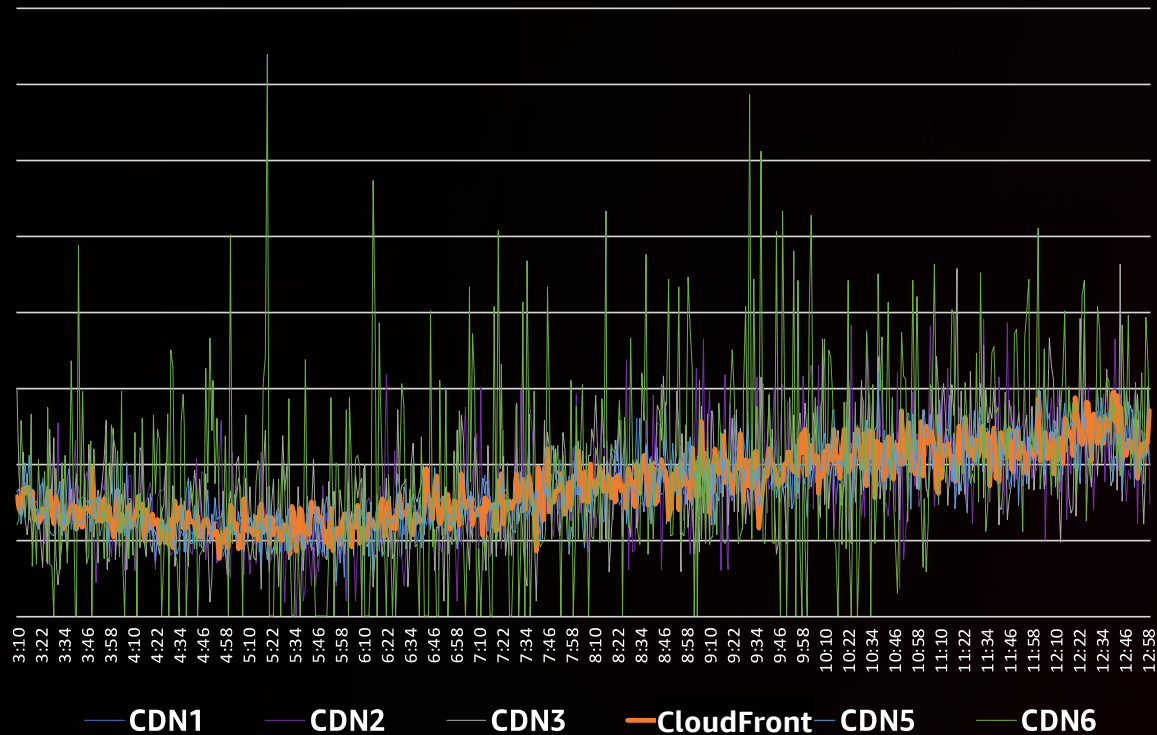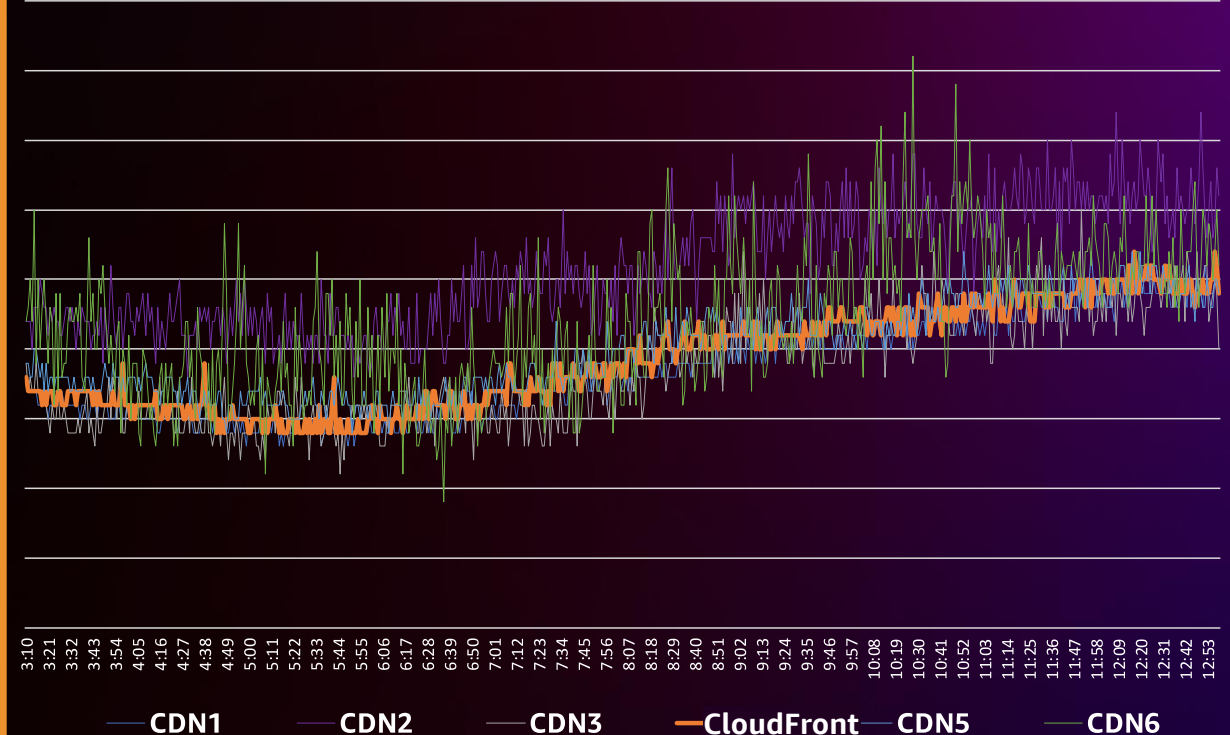

Video Start Failure

Video Playback Failure

CDN1   CDN2   CDN3   CloudFront   CDN5   CDN6
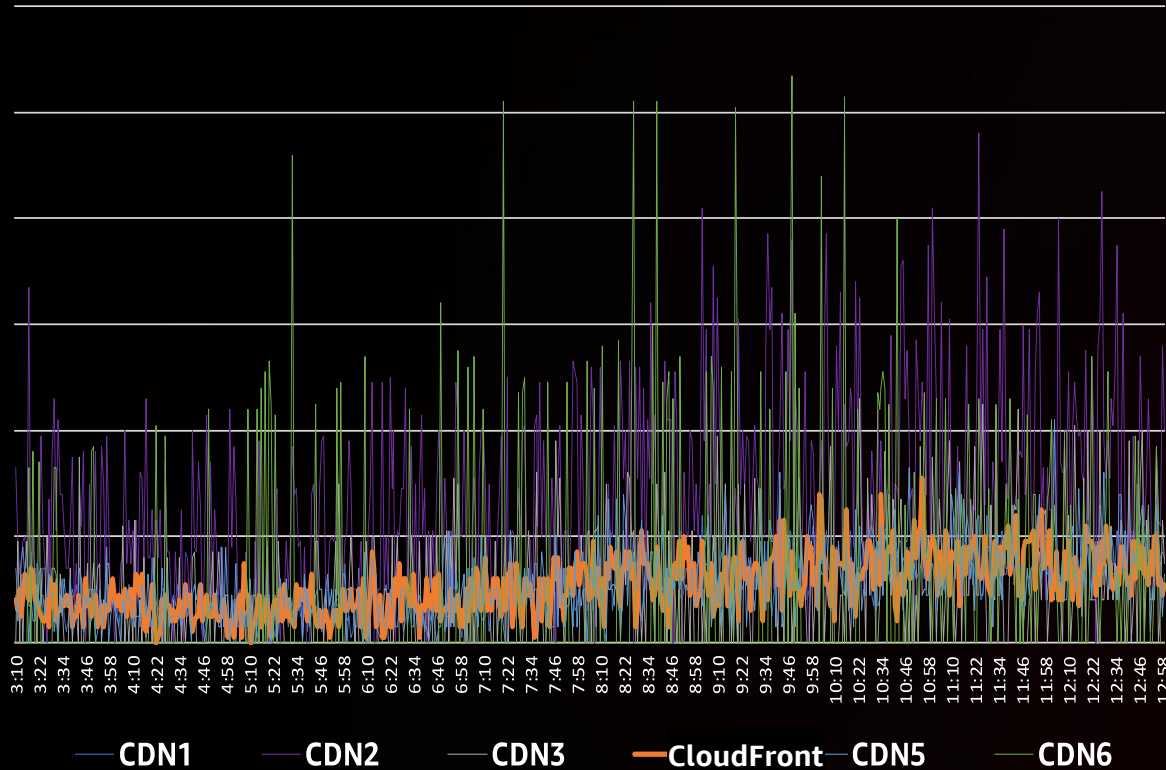
Performance & resiliency strategy – QoE KPI's

Exit Before Video Start

CDN1 CDN2 CDN3 CloudFront CDN5 CDN6

Rebuffering Video

CDN1 CDN2 CDN3 CloudFront CDN5 CDN6

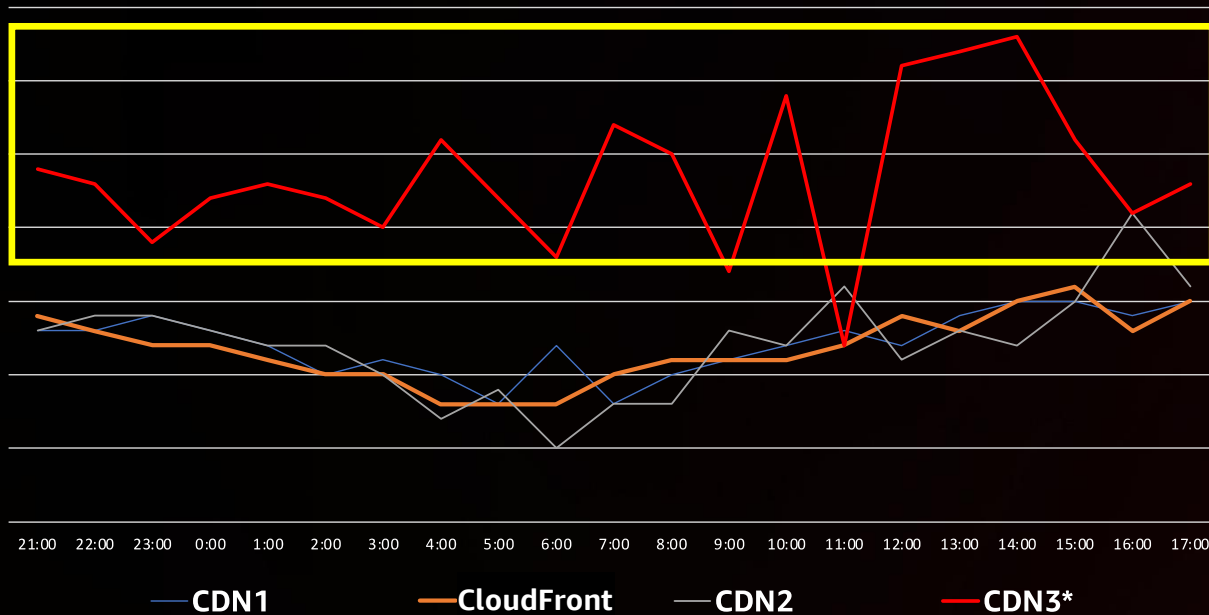# Performance & resiliency strategy - QoE KPI's
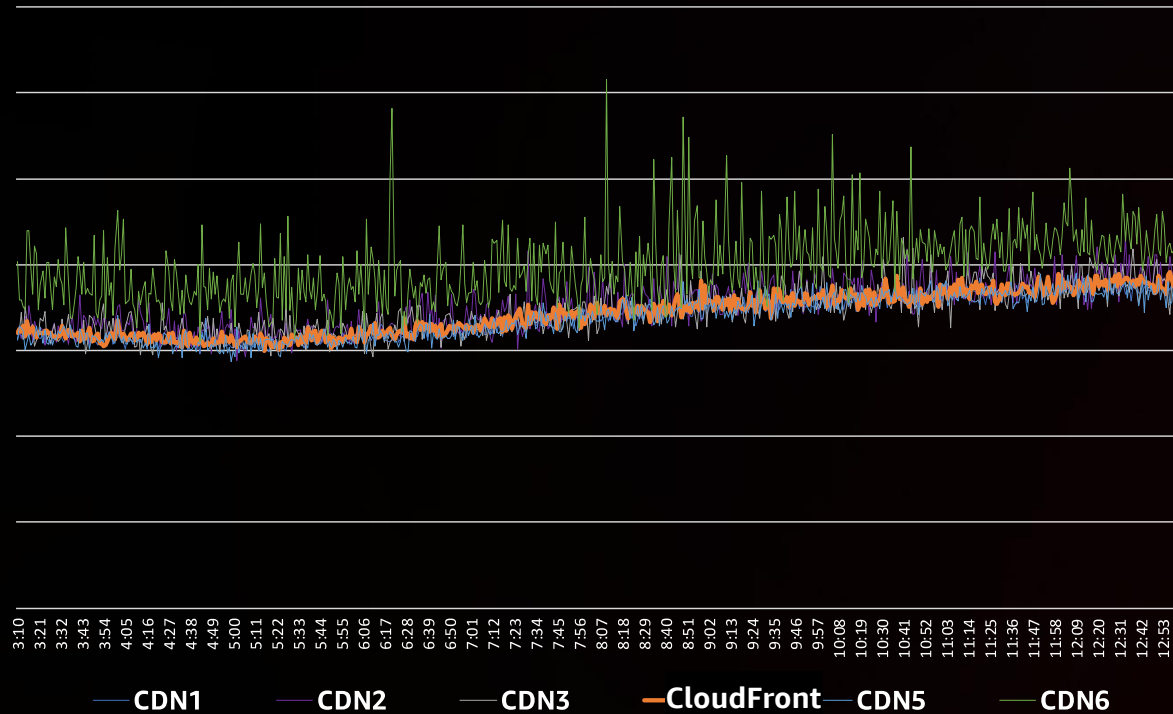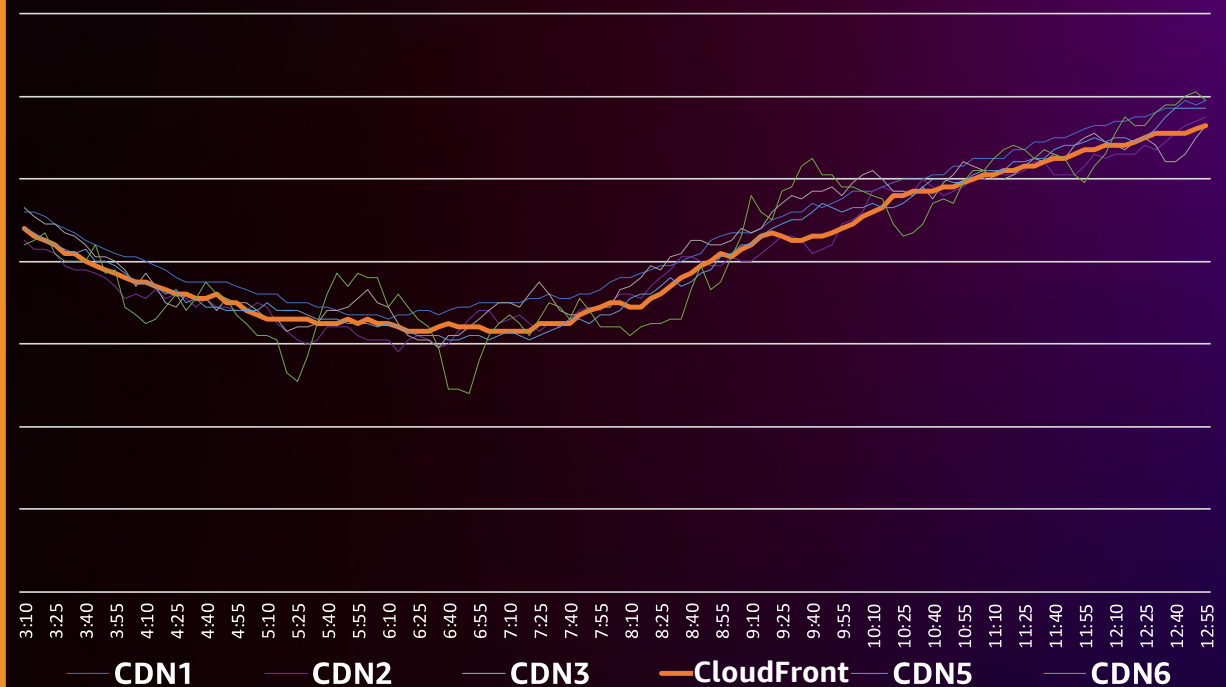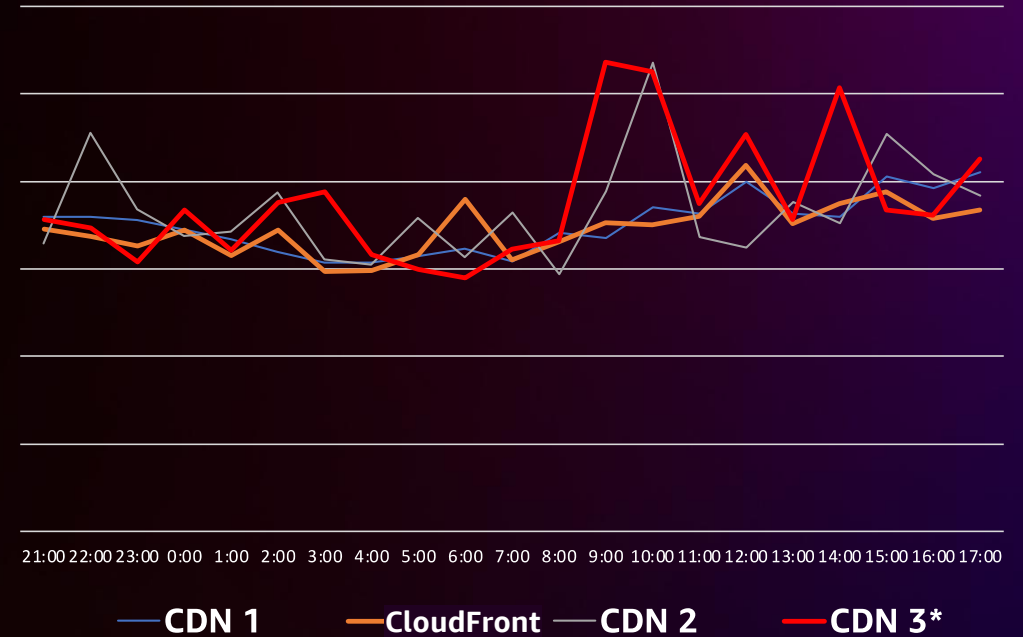
Performance & resiliency strategy - QUIC

QUIC implementation
- ○ Launch partner
- ○ ~10% adoption rate
- ○ Improved rebuffering and video start times

Rebuffering Ratio

Video Start Time

21:00 22:00 23:00 0:00 1:00 2:00 3:00 4:00 5:00 6:00 7:00 8:00 9:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00

CDN1   CloudFront   CDN2   CDN3*

21:00 22:00 23:00 0:00 1:00 2:00 3:00 4:00 5:00 6:00 7:00 8:00 9:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00

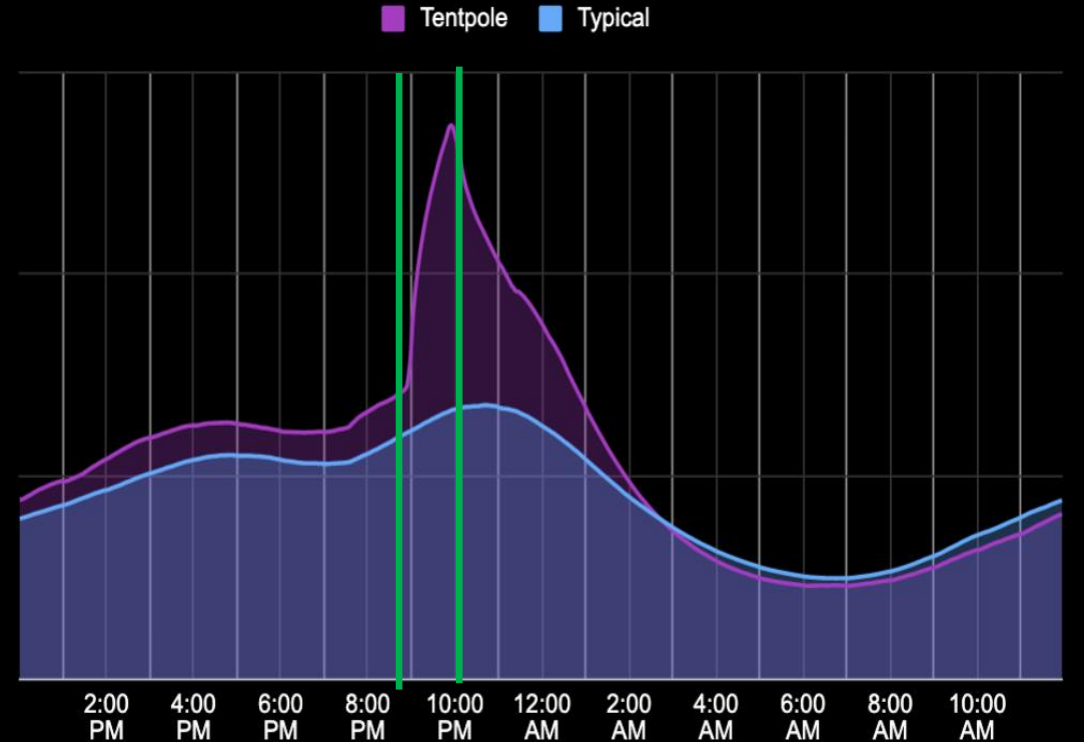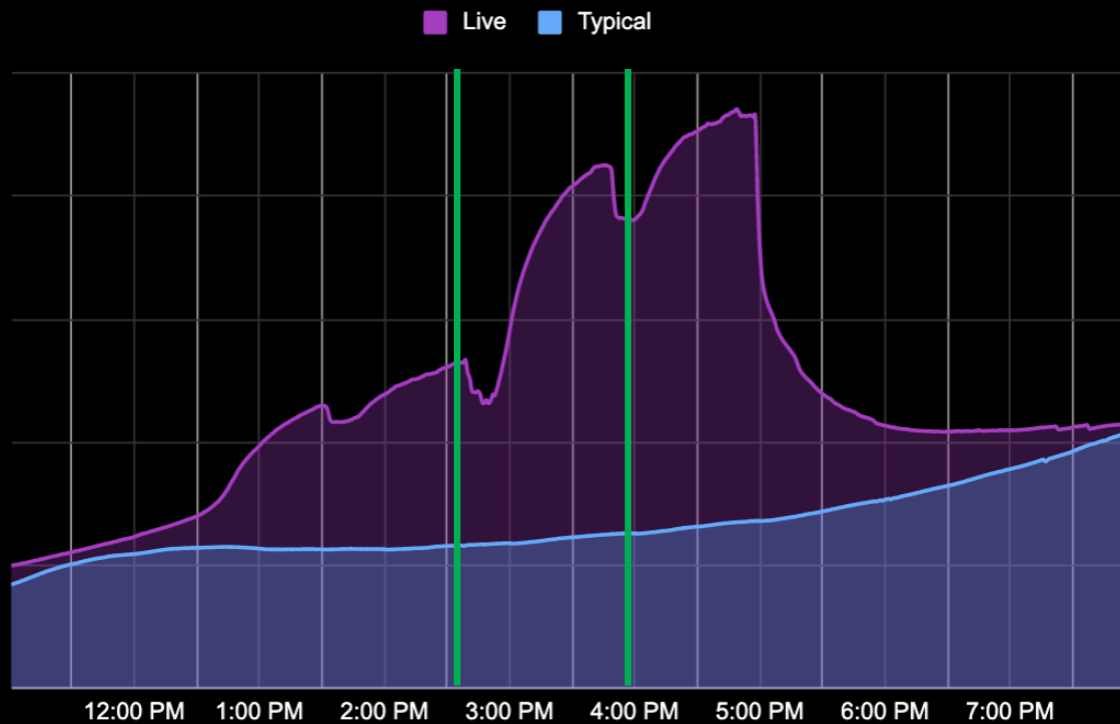CDN 1   CloudFront   CDN 2   CDN 3*

* No QUIC Protocol Enabled

HBO Max traffic patterns

Traffic patterns can vary greatly on any given day
- ○ Live Sports Events (LATAM)
- ○ Tent Pole Events (Episodic release , movie release)

Event management & strategy

For these events, HBO Max uses a "war room" operational approach for monitoring and collaboration with AWS

- Capacity planning
- Pre-scaling and pre-warming
- Operational monitoring
- AWS Infrastructure Event Management (IEM)
- AWS Elemental Media Event Management (MEM)

HBO ORIGINAL

GAME OF THRONES

HOUSE OF THE DRAGON

Looking forward

- **Amazon CloudFront Blue Green Deployment**

  - Ability to test before applying any configuration change simplifies configuration management of updates

- **Bringing HBO Max and Discovery+ content together in an enhanced streaming platform**

  - Coming in 2023

- **Continued global expansion of the enhanced platform**

- **So what's next on HBO Max?**

To learn more about using CloudFront for your media delivery:

https://aws.amazon.com/cloudfront/media/

Thank you!

Please complete the session survey in the **mobile app**