



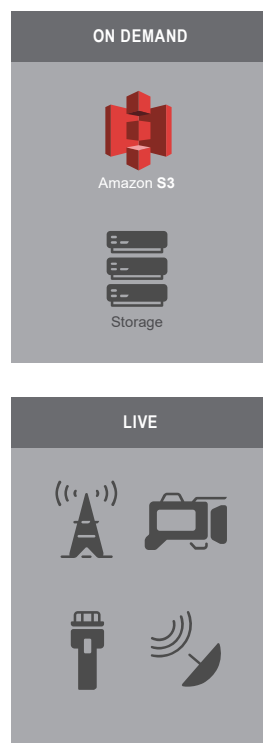
STREAMING MEDIA: LIVE TO VOD

Jamie Duemo

Senior Product Manager – AWS Elemental Live

WHERE IS OUR TECHNOLOGY DEPLOYED?

CONTENT



MARKETS



DISPLAYS



AWS acquired Elemental Technologies October, 2015

SOME OF AWS ELEMENTAL'S CUSTOMERS

Pay TV Operators



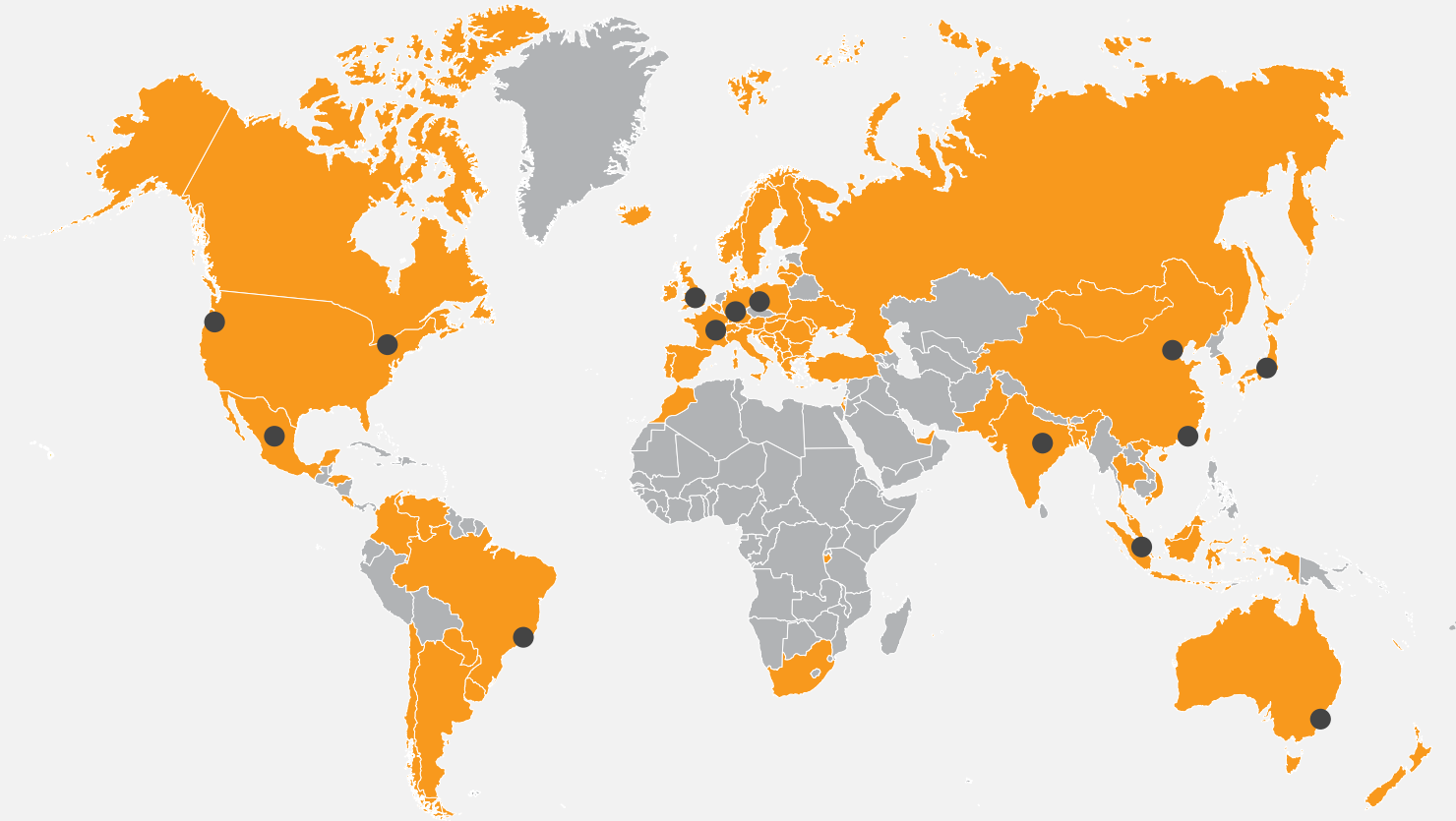
Content Owners



Broadcast / Sports / Other



DEPLOYMENTS IN MORE THAN 75 COUNTRIES

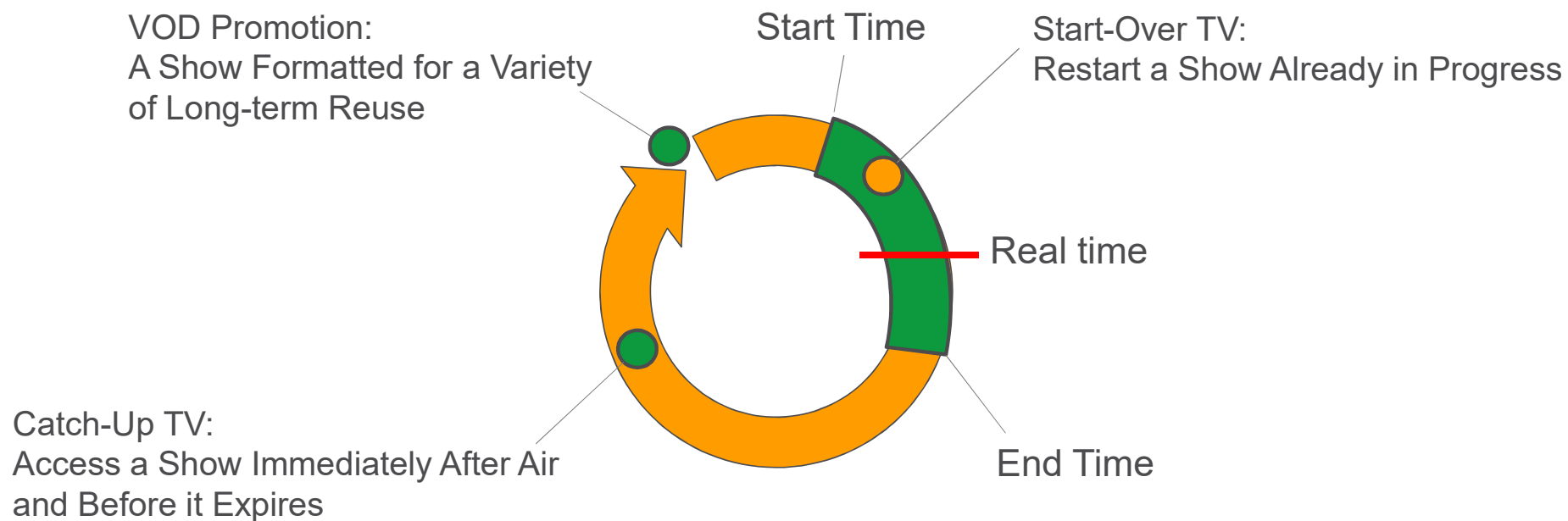


AWS Elemental has offices in 14 regions around the world

LIVE TO VOD: OVERVIEW

- What is frame-accurate Live to VOD?
- Introduction to demonstrated services
- The Live to VOD lifecycle
 - Start-Over TV and Catch-Up TV
 - VOD Promotion for continual repurpose
 - VOD with Dynamic Ad Insertion
 - Seamless VOD
- Live to VOD frame-accurate clipping
 - Quick-to-Consumer content

WHAT IS FRAME ACCURATE LIVE TO VOD?



LIVE TO VOD: QUICK INTRODUCTION TO THE SERVICES

LIVE VIDEO PROCESSING



AWS Elemental
LIVE

VIDEO DELIVERY PLATFORM



AWS Elemental
DELTA

STORAGE



AWS **S3**

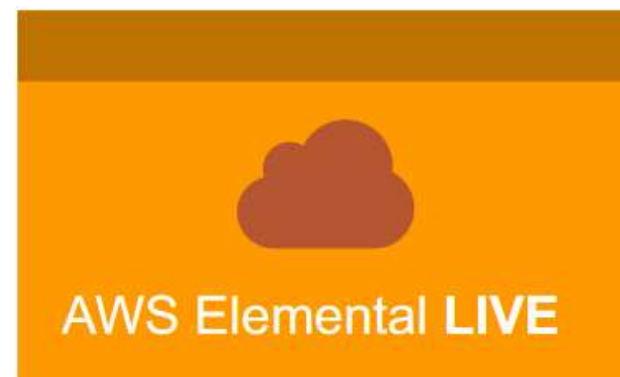
CDN



Amazon **CLOUDFRONT**

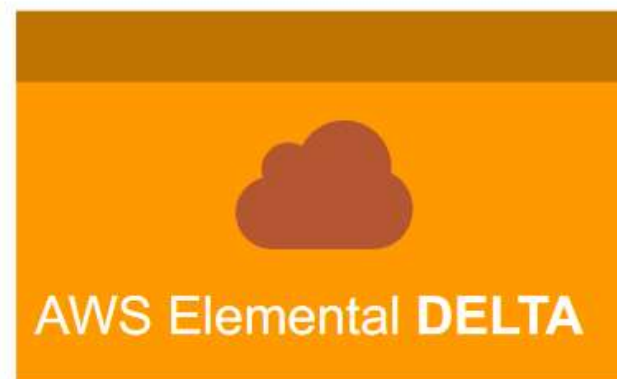
LIVE TO VOD: AWS ELEMENTAL LIVE

- Live encoding for multiscreen applications
- SDI, IP, file inputs
- TS, HLS, DASH outputs
- SCTE-35 insertion
- Broad Caption and DRM support
- RESTful API



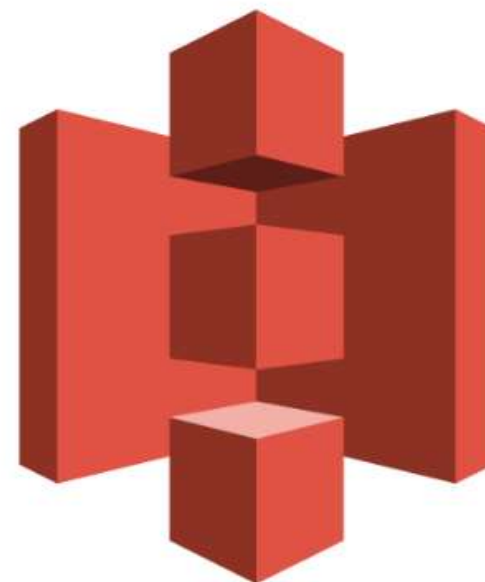
LIVE TO VOD: AWS ELEMENTAL DELTA

- Just-in-time media packaging and encryption
- Power non-linear services
- Static ad removal, replacement, insertion
- User-agent detection & content routing
- **Frame accurate clip creation**
- Analytics
- RESTful API



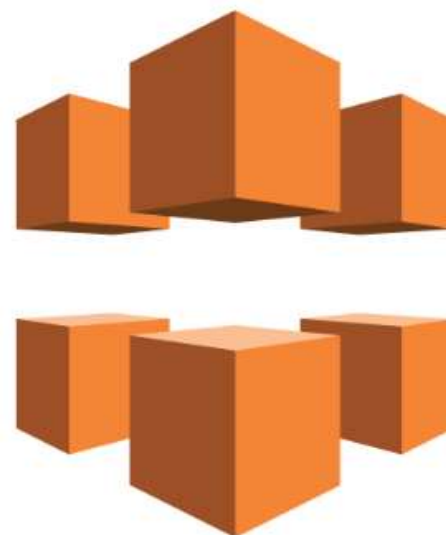
LIVE TO VOD: AWS SIMPLE STORAGE SERVICE (S3)

- Simple, durable, scalable object storage
- Store and retrieve any amount of data from anywhere on the web over HTTP
- Web, CLI, and SDK
- Event Notifications
- Lifecycle Policies

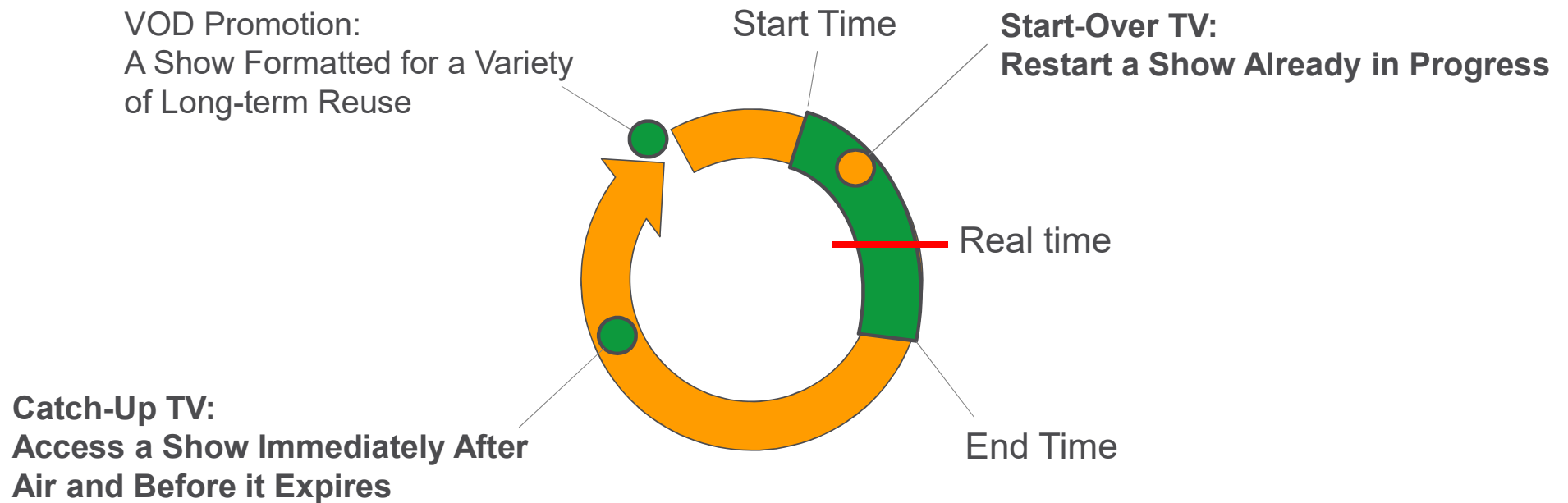


LIVE TO VOD: AWS CLOUDFRONT

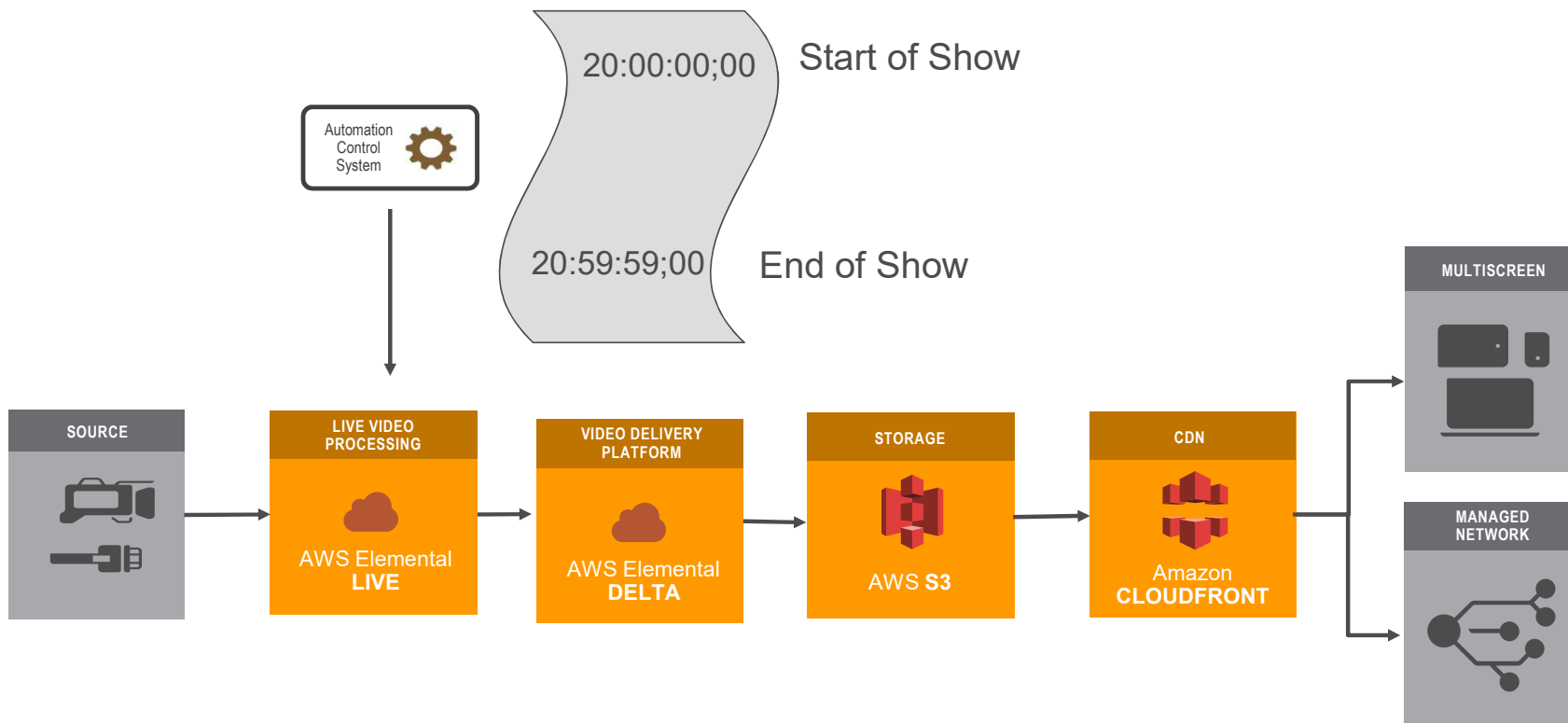
- Global Content Delivery Network
- Accelerates delivery of websites, APIs, video assets, or any other web content
- Broad integration with other AWS Services



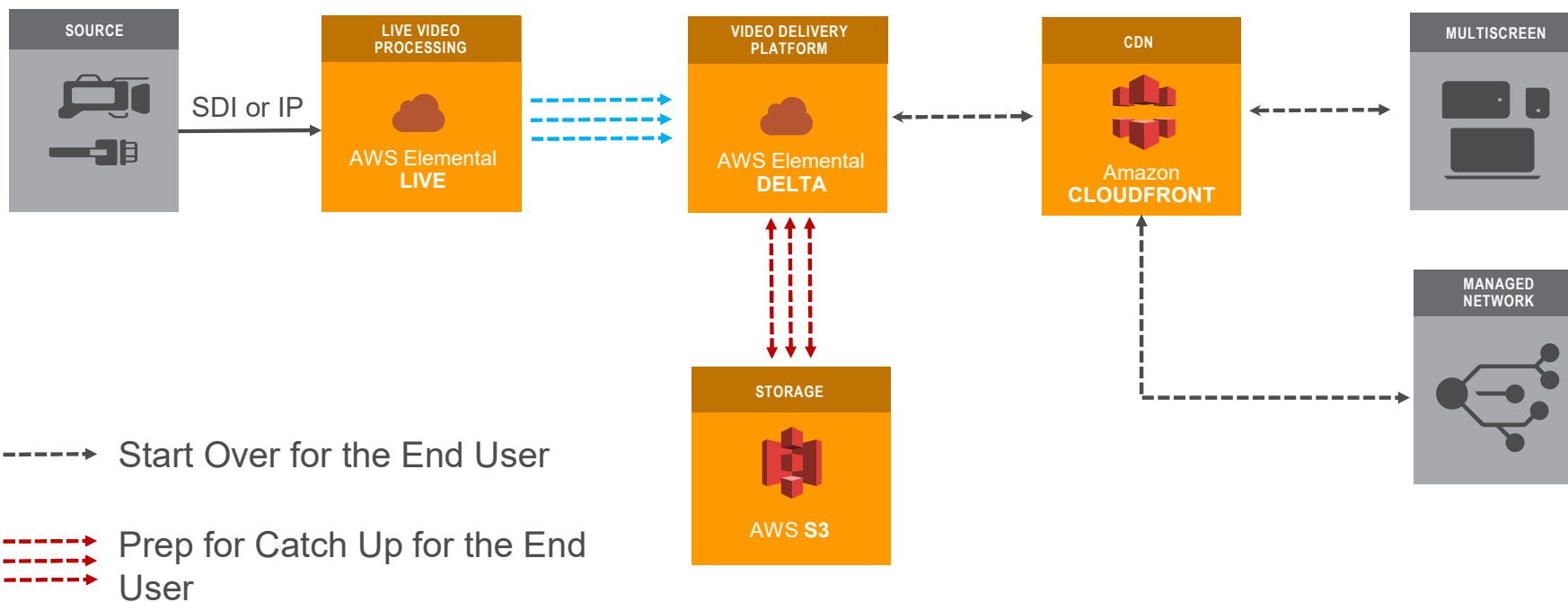
LIVE TO VOD: START-OVER AND CATCH-UP TV



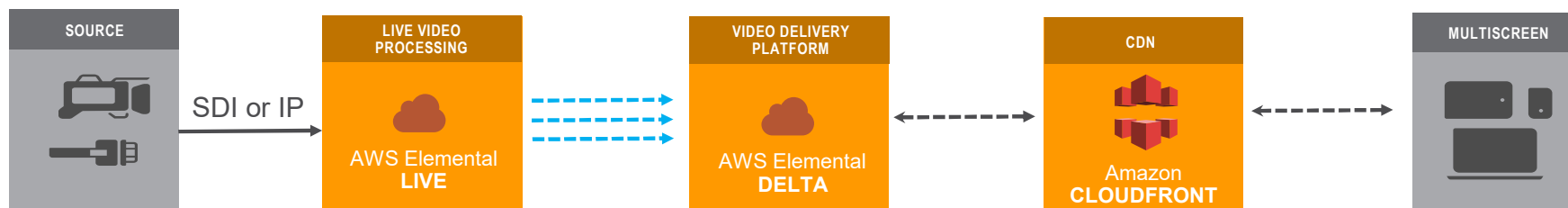
LIVE TO VOD: START-OVER AND CATCH-UP TV



LIVE TO VOD: START-OVER AND CATCH-UP TV (DETAILED VIEW)



LIVE TO VOD: START-OVER (DETAILED VIEW)



VOD Schedule

Start ⓘ	2017-06-12T20:00:00-07:00	📅
End ⓘ	2017-06-12T22:00:00-07:00	📅

☒ Start Over ⓘ

Cancel ⓘ

Create +

-----> Start Over for the End User

-----> Prep for Catch Up for the End User

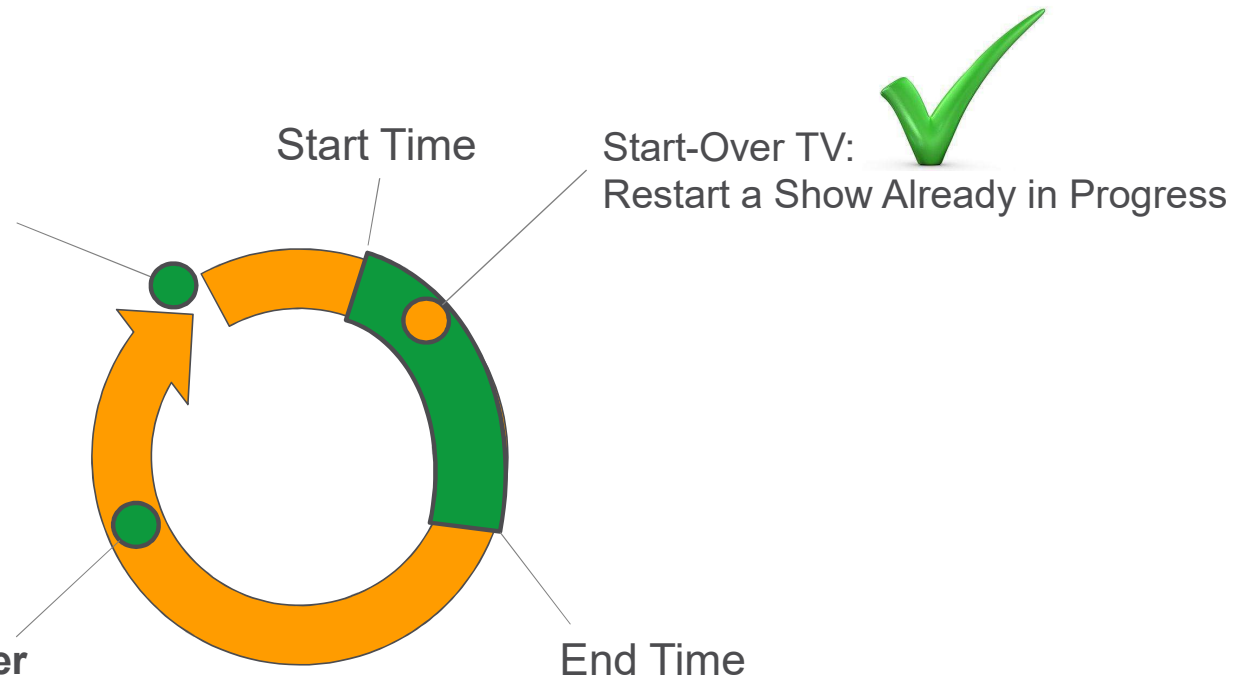
LIVE TO VOD: CATCH-UP TV

VOD Promotion:

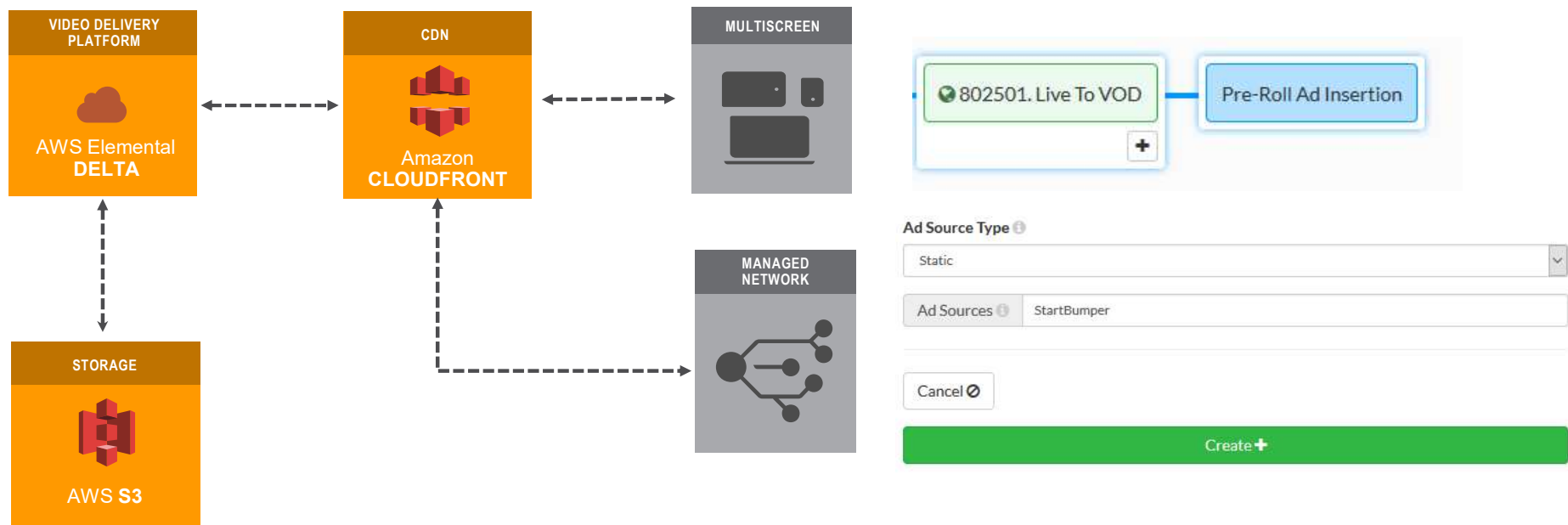
A Show Formatted for a Variety of Long-term Reuse

Catch-Up TV:

Access a Show Immediately After Air and Before it Expires



LIVE TO VOD: CATCH-UP TV (DETAILED VIEW)



LIVE TO VOD: CATCH-UP TV (DETAILED VIEW)

While watching this show, Fast Forward and other functions may not be available.



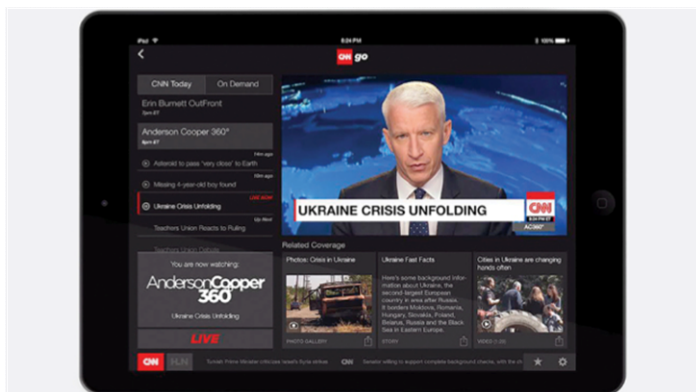


LIVE TO VOD CUSTOMER USE CASE

CNN GO / TURNER BROADCASTING SYSTEM

Challenge

- Turner Broadcasting System is a world leader in online news and information delivery
- Create an innovative digital extension that fuses both live linear programming and on-demand content in a single application



Solution

- **A live channel that plays in a web browser or tablet app, surrounded by additional content options**
- AWS Elemental Live encoders power the CNN Go app to deliver live and VOD content to viewers
- AWS Elemental Delta is used as the video delivery platform

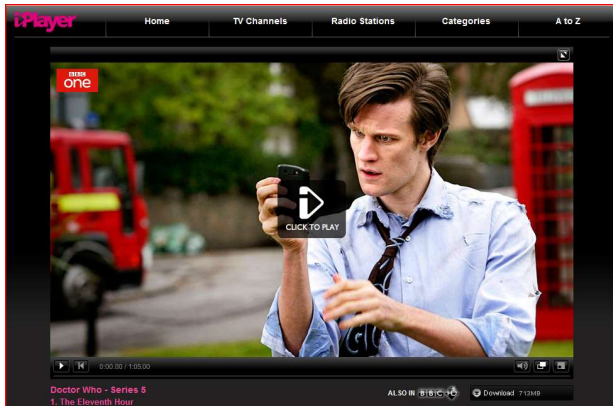
Benefit

- Includes contextual links that offer CNN-produced video, text, tweets and photos relevant to live discussions
- Gives viewers progressive viewing experiences and enhances the way people watch news
- Extracts more value out of content by creating an interactive experience

BBC VIDEO FACTORY

Challenge

- The BBC iPlayer serves more than 7 million users per day on more than 1,000 devices and platforms
- On Demand Product Service (ODPS) had a maximum capacity of only 40 hours of HD video per week
- Significant delay in posting catch-up programming



Solution

- Retire ODPS and launch Video Factory
- **Video Factory integrates AWS Elemental Cloud for elastic video processing of content for the BBC iPlayer**
- Dynamic scaling of cloud-based resources manages spikes in processing demand

Benefit

- Eliminates processing capacity as a blocker
- Allows for much faster delivery of live programs
- Ensure all content is available on all devices
- Easily adapt iPlayer service to add new devices
- Flexibility to scale up or down and pay only for video processing resources used

STOFA LIVE LINEAR AND CATCH-UP TV

Challenge

- Leading Danish pay TV operator and broadband internet service provider seeking to augment its broadband services, with a full range of multiscreen offerings
- Expand multiscreen services and enhance system to support new devices and video profiles as needed



Solution

- **Stofa uses AWS Elemental video processing solutions to process, package and manage live linear channels in real time for its catch-up TV and multiscreen video services**
- Future-proof infrastructure as offerings are enhanced to support new devices and profiles

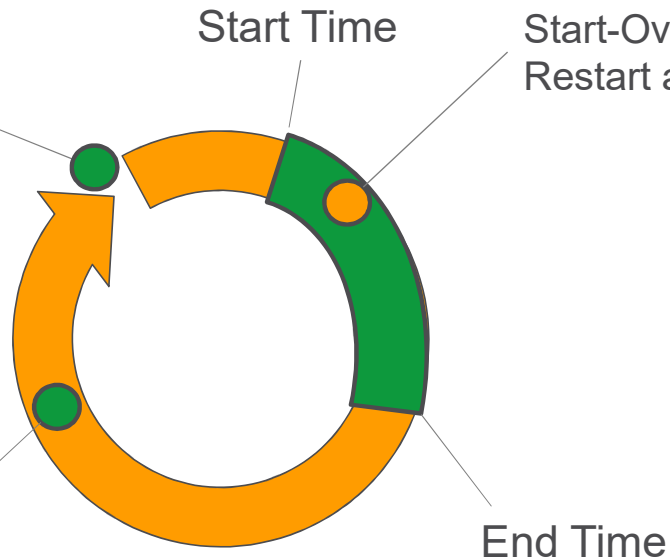
Benefit

- AWS Elemental video infrastructure customizes 150 TV channels – including 38 in high definition – for delivery to subscribers
- Complete AWS Elemental video processing solution is fully integrated within the Stofa broadcast workflow, utilizing software-defined video

LIVE TO VOD: VOD PROMOTION

VOD Promotion:
A Show Formatted for a Variety of
Long-term Reuse

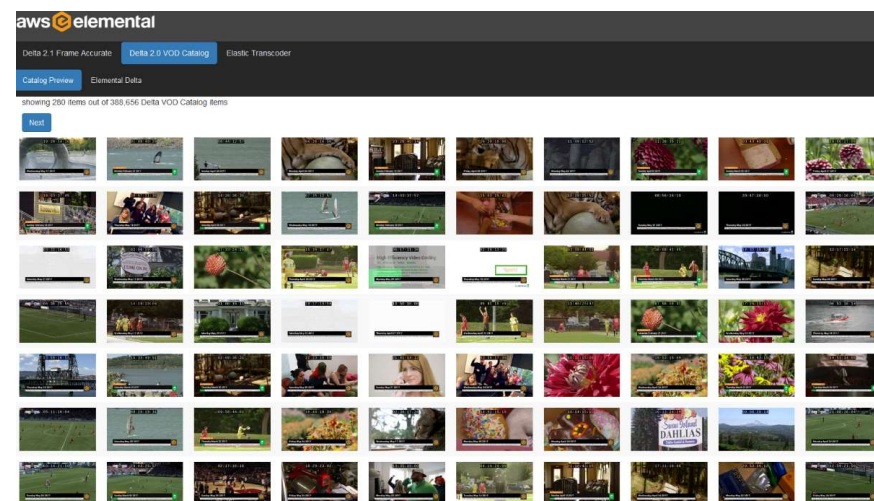
 Catch-Up TV:
Access a Show Immediately After Air
and Before it Expires



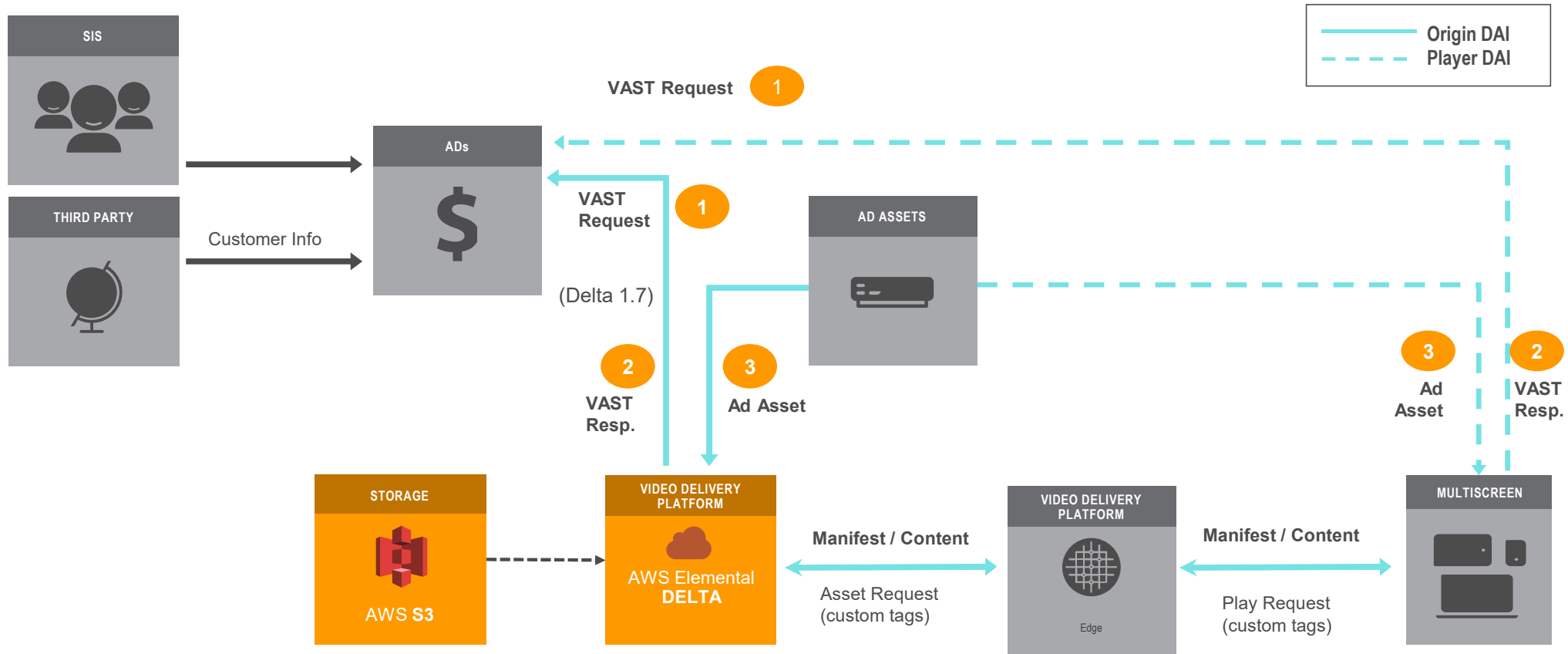
 Start-Over TV:
Restart a Show Already in Progress

LIVE TO VOD: VOD PROMOTION

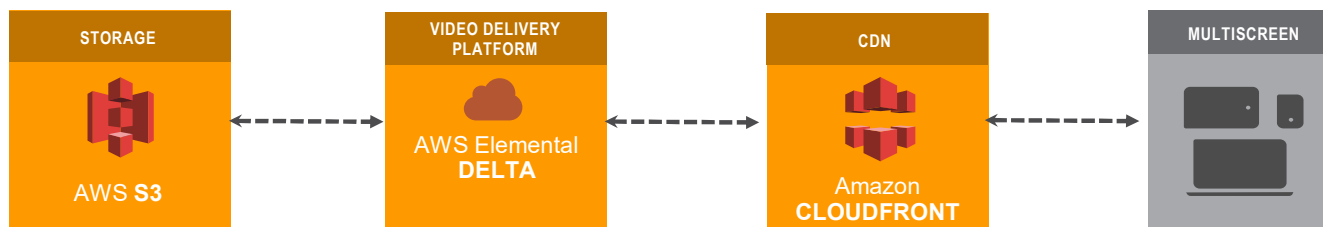
- Promotion to VOD Catalog
 - Central repository access for all connected nodes
 - Allows for life-long reuse
 - Assets can be repurposed for dynamic advertising
 - Assets can be repurposed commercial free for SVOD premium services



LIVE TO VOD: DYNAMIC AD INSERTION – CLIENT & SERVER

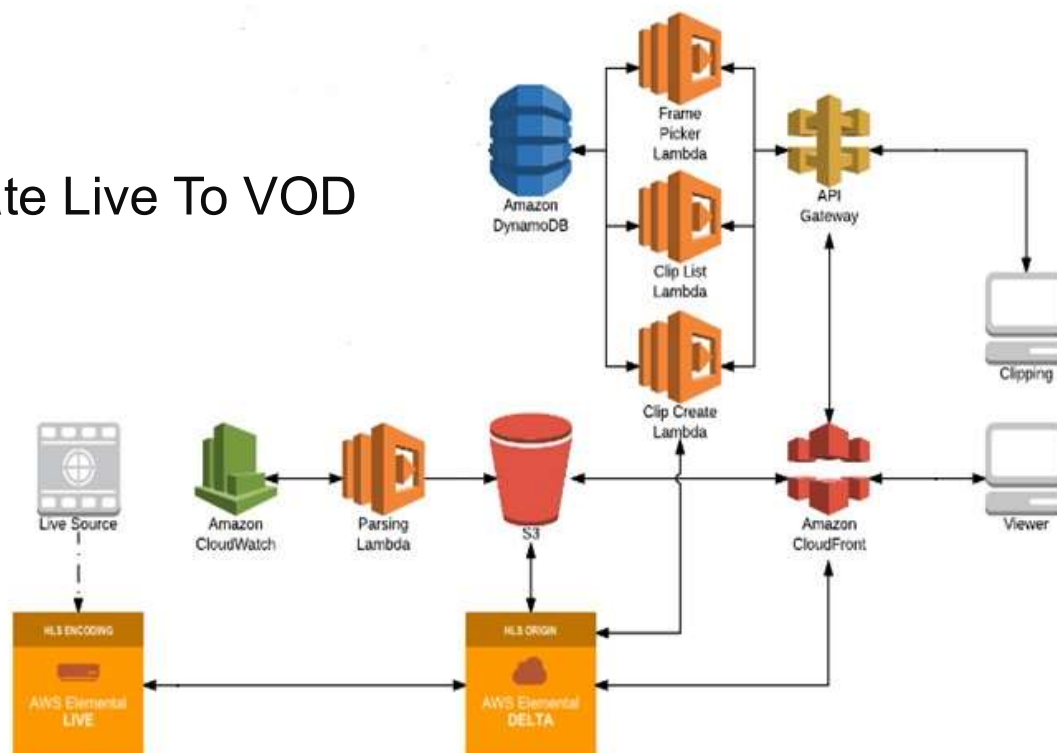


LIVE TO VOD: PREMIUM SUBSCRIPTION VOD



LIVE TO VOD: FRAME ACCURATE CLIPPING

- Winning the race with frame-accurate Live To VOD
 - Quick-to-Consumer content
 - Get to the viewer first



LIVE TO VOD: AWS LAMBDA

- No servers to manage
- Continuous scaling of compute
- Bring your own code
 - Python, Java, Node.js
- Broad integrations with AWS services



LIVE TO VOD: AWS DYNAMODB

- Fully managed NoSQL database
- Fast and consistent performance
- Highly scalable
- Flexible
- Event Notifications
- Fine-grained access control



LIVE TO VOD: AWS CLOUDWATCH

- Monitoring and logging service
- Collect and track metrics
- Collect and monitor log files
- Automatically manage resources
- Alarms and **events**

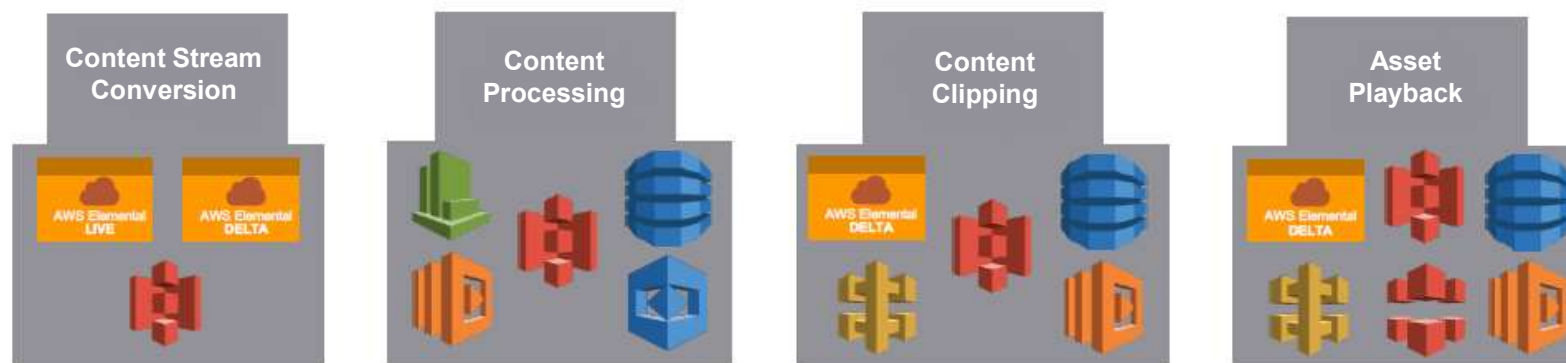


LIVE TO VOD: AWS API GATEWAY

- “Front door” for your HTTP API
- Decouple API from backend services
- Authenticate and authorize requests
- Protection and throttling for backend services

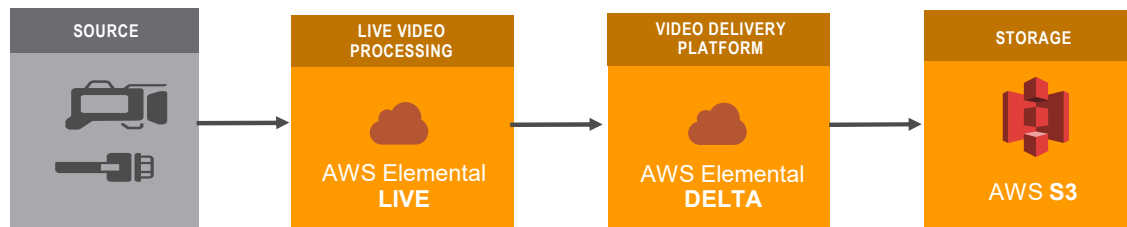


LIVE TO VOD: CONTENT WORKFLOW PHASES



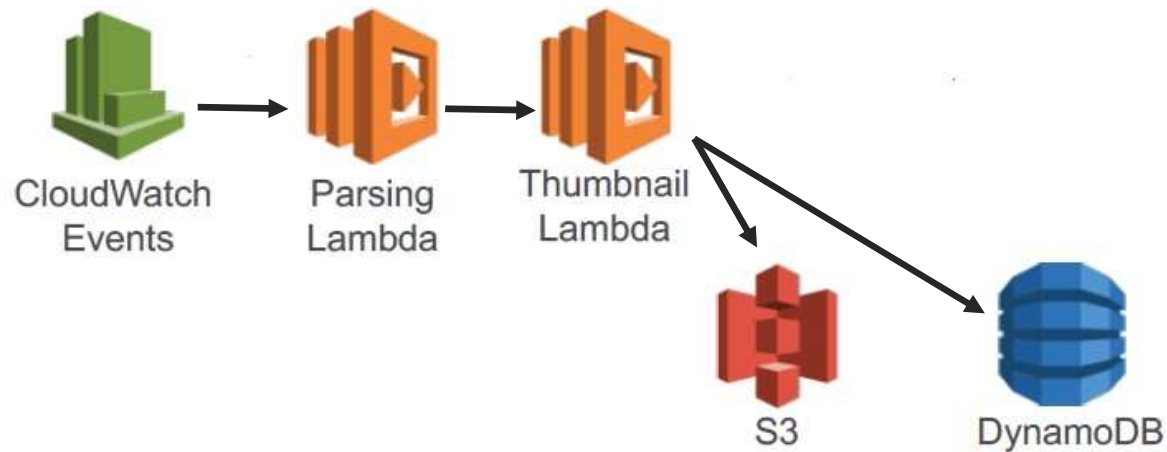
- The content moves through four phases
- Content is perpetually processed
- Near real time process which can be fine tuned based on requirements

LIVE TO VOD: CONVERTING THE LIVE STREAM TO VOD



- Live creates 1 second segments and decorates the manifest
 - Uses Program-Date-Time tags
- Delta consumes content and stores on S3

LIVE TO VOD: PREPARING CONTENT FOR FRAME BROWSER



- CloudWatch Events processes the new segments
 - Invokes the “Parsing” Lambda on a timer
- “Parsing” Lambda invokes “Thumbnail” Lambda
 - Creates a thumbnail for every frame and stores in S3
 - Updates the DynamoDB database

LIVE TO VOD: SELECT THE CONTENT AND CLIP



LIVE TO VOD: SELECT THE CONTENT AND CLIP



- The website calls “Polling” API Gateway to check for updated content
 - Gets the latest available content by checking for updates in DynamoDB

LIVE TO VOD: SELECT THE CONTENT AND CLIP

The screenshot displays the AWS Elemental Live to VOD interface. On the left, a grid of video thumbnails is shown, each featuring a glowing lightbulb. The thumbnails are labeled with time or frame markers: 'second: 00', 'second: 01', 'second: 02', 'frame: 0', and 'frame: 1'. On the right, a 'Start Time' and 'End Time' selection panel is visible. The 'Start Time' is set to '2017-06-12 22:25:00' and the 'End Time' is set to '2017-06-12 22:25:04'. Below these time selectors, a 'Submit Frame Accurate' button is present. Further down, two more thumbnails are shown, labeled 'frame: 0' and 'frame: 1'. The AWS Elemental logo is in the bottom left corner, and the Amazon Web Services logo is in the bottom right corner.

second: 00

second: 01

second: 02

frame: 0

frame: 1

Start Time

2017-06-12 22:25:00

1

End Time

2017-06-12 22:25:04

1

Submit Frame Accurate

frame: 0

frame: 1

aws elemental

Amazon Web Services

LIVE TO VOD: SELECT THE CONTENT AND CLIP



- Button push on the website calls the “Submit” API Gateway
 - Sends the selected information to a “VOD Put” Lambda which provides the information to Delta
 - “Thumbnail” Lambda updates DynamoDB with the selected thumbnails Get information for webpage

LIVE TO VOD: CLIP ASSET PLAYBACK

Frame Chooser

Archive List

Elemental Live

Elemental Delta

Overview

Chosen Frames

2017-06-12 22:25:00:01

UTC 22:25:00:01



ELEMENTAL

Start Frame

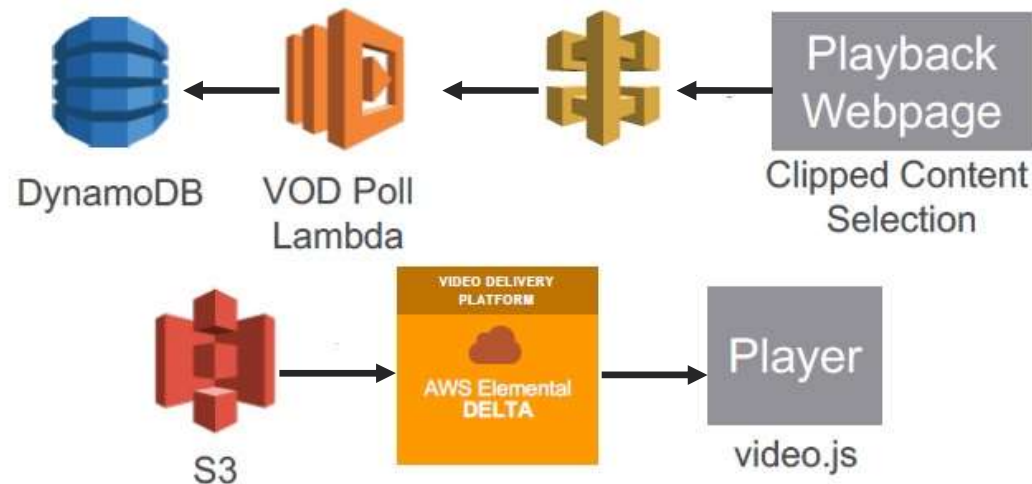
End Frame

Delta Filter Info

```
{
  "1629": {
    "start_frame": "1",
    "start_time": "2017-06-12T22:25:00Z",
    "end_frame": "1",
    "end_time": "2017-06-12T22:25:04Z",
    "type": "live_to_vod",
    "id": "1629"
  },
  "1630": {
    "endpoint": "http://delta-1-xa919ka31n3d5.cloud.elementaltechno",
    "type": "mp4_package",
    "id": "1630"
  },
  "1631": {
    "endpoint": "http://delta-1-xa919ka31n3d5.cloud.elementaltechno",
    "type": "hls_package",
    "id": "1631"
  }
}
```

Video Information

LIVE TO VOD: CLIP ASSET PLAYBACK



- “VOD Poll” Lambda checks DynamoDB waiting for website detail readiness
 - Polls the database to verify all data needed to display the webpage is ready
- The website is serverless and driven by S3 static website hosting
 - Open source .js player allows verification of content before publishing



THANK YOU!

Jamie Duemo Senior Product Manager – AWS Elemental Live