ARC303

Pure Play Video, Over-The-Top

A Microservices Architecture in the Cloud

Alex Smith, ASEAN Media Solutions Architect, AWS
Vidhya Narayanan, Director, Verizon onCue

October 2015

The Problem

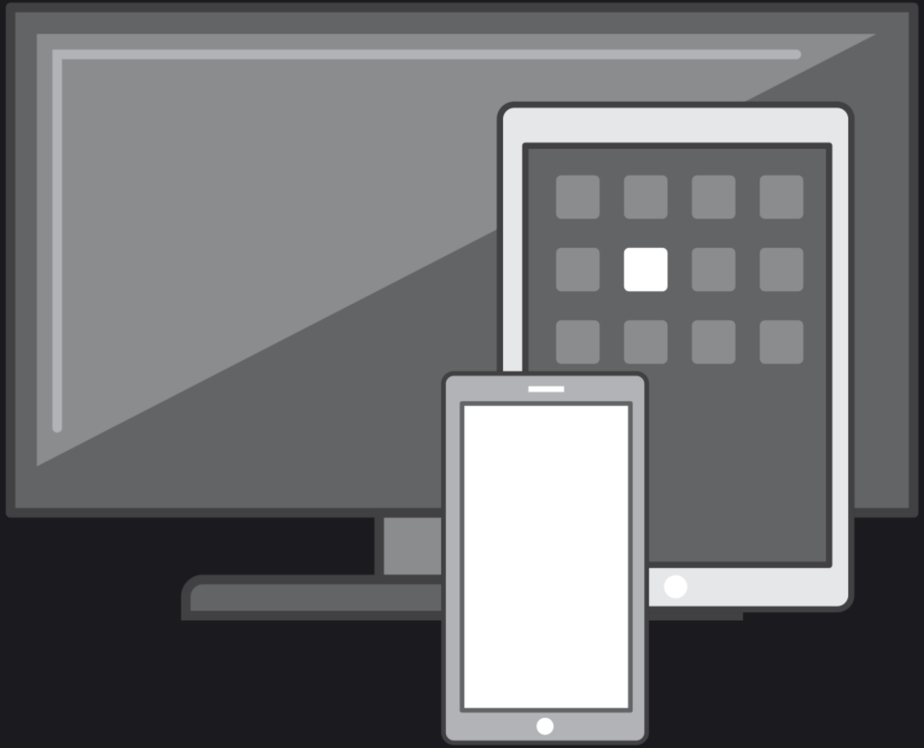
Your Consumers Have Changed

More content choices

More devices

More delivery methods

New experiences



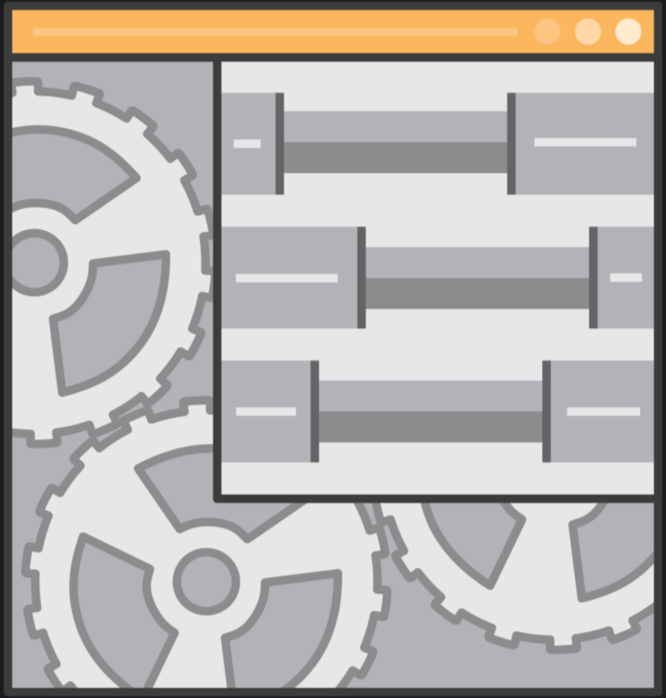
Your Business Has Changed

More data

Faster go to market

Leaner teams

Innovation and failure



What to Expect from the Session

~~Content is king~~

Building from scratch

Battle-hardened lessons – Verizon onCue

Clarifications

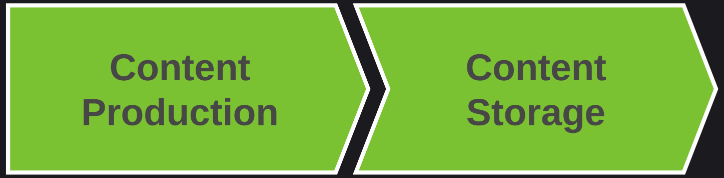
<u>OTT, OVP, AVOD, TVOD, SVOD</u>

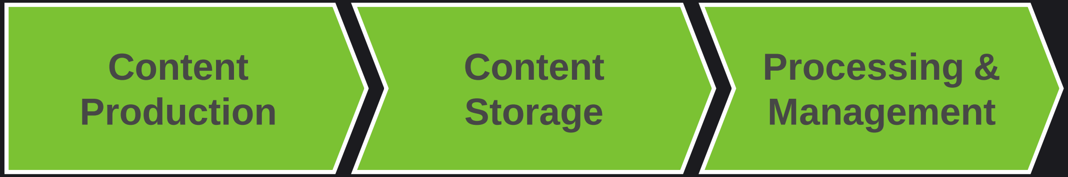
- It doesn’t matter

<u>Microservices</u>

- Buzzword?
- Specific scope, interoperable services
- Allow rapid innovation

Over the Top Platform


Content Production
Content Storage


Content Production
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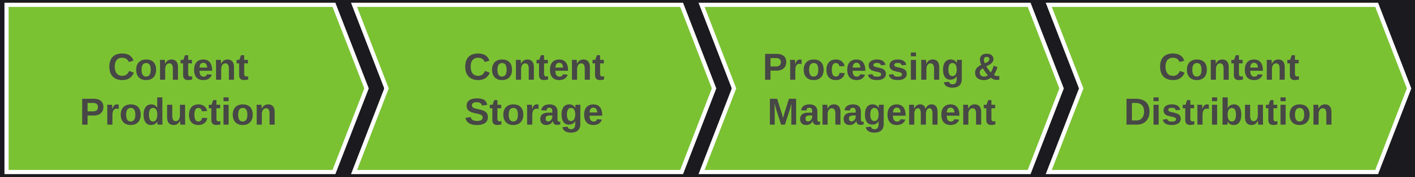
Processing & Management


Content Production
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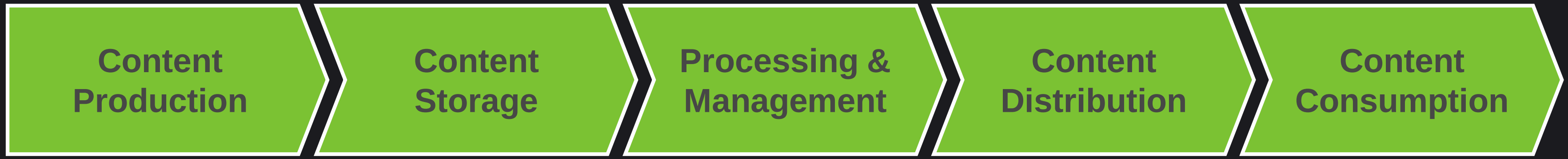
Content Distribution


Content Production
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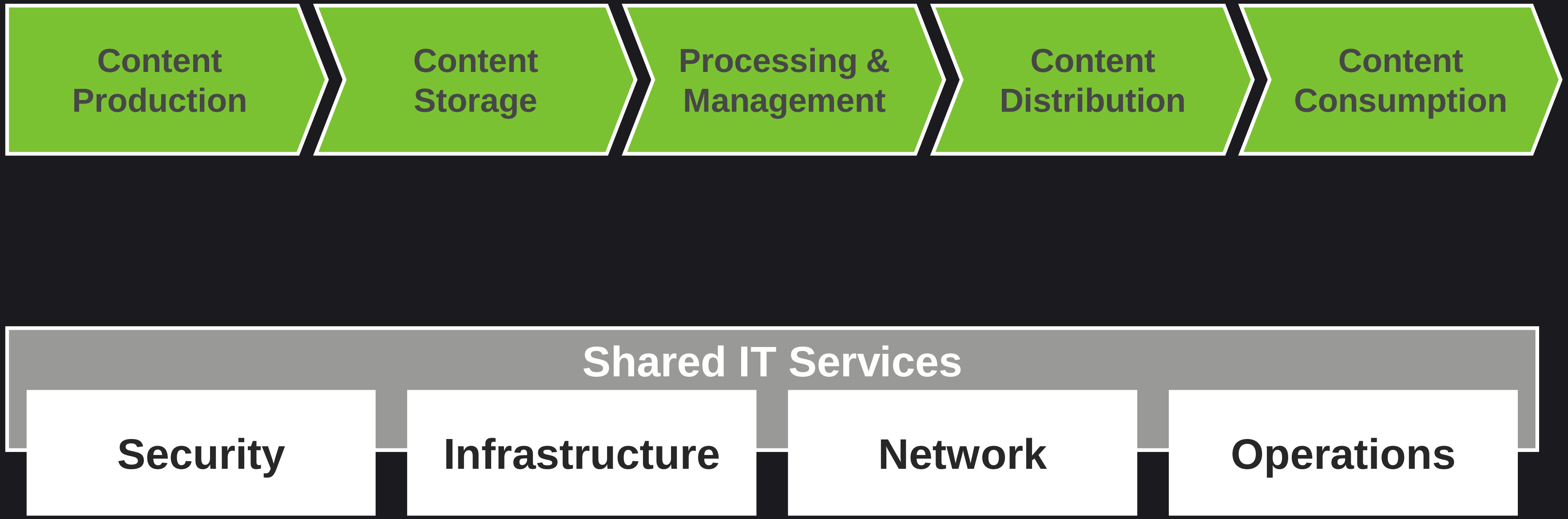
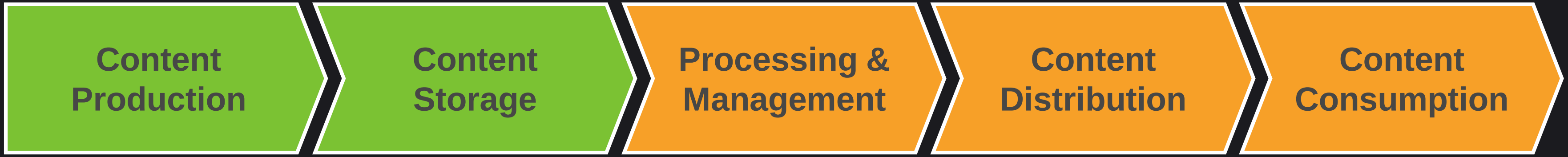
Content Consumption


Content Production
Content Storage
Processing & Management
Content Distribution
Content Consumption
Shared IT Services
Security
Infrastructure
Network
Operations


Content Production
Content Storage
Processing & Management
Content Distribution
Content Consumption

Your Existing Physical Requirements

HD-SDI

Satellite transmission

Local SAN

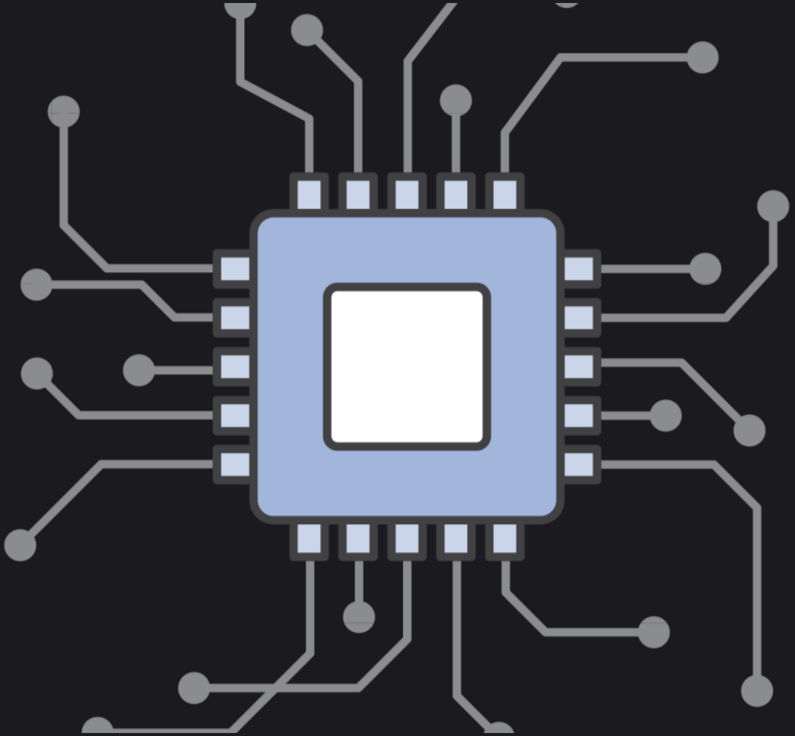
HW transcoder

Your OTT Approach

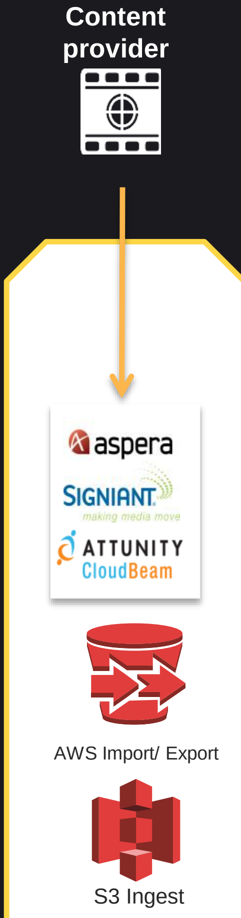
FTP / Accelerator

Large NAS

DAM / Workflow System



Storage and Ingest — Serverless



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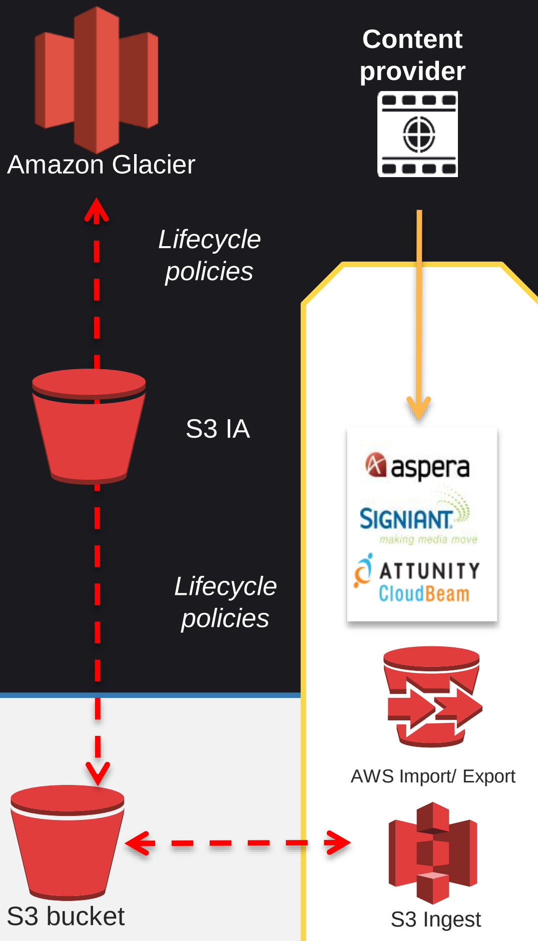

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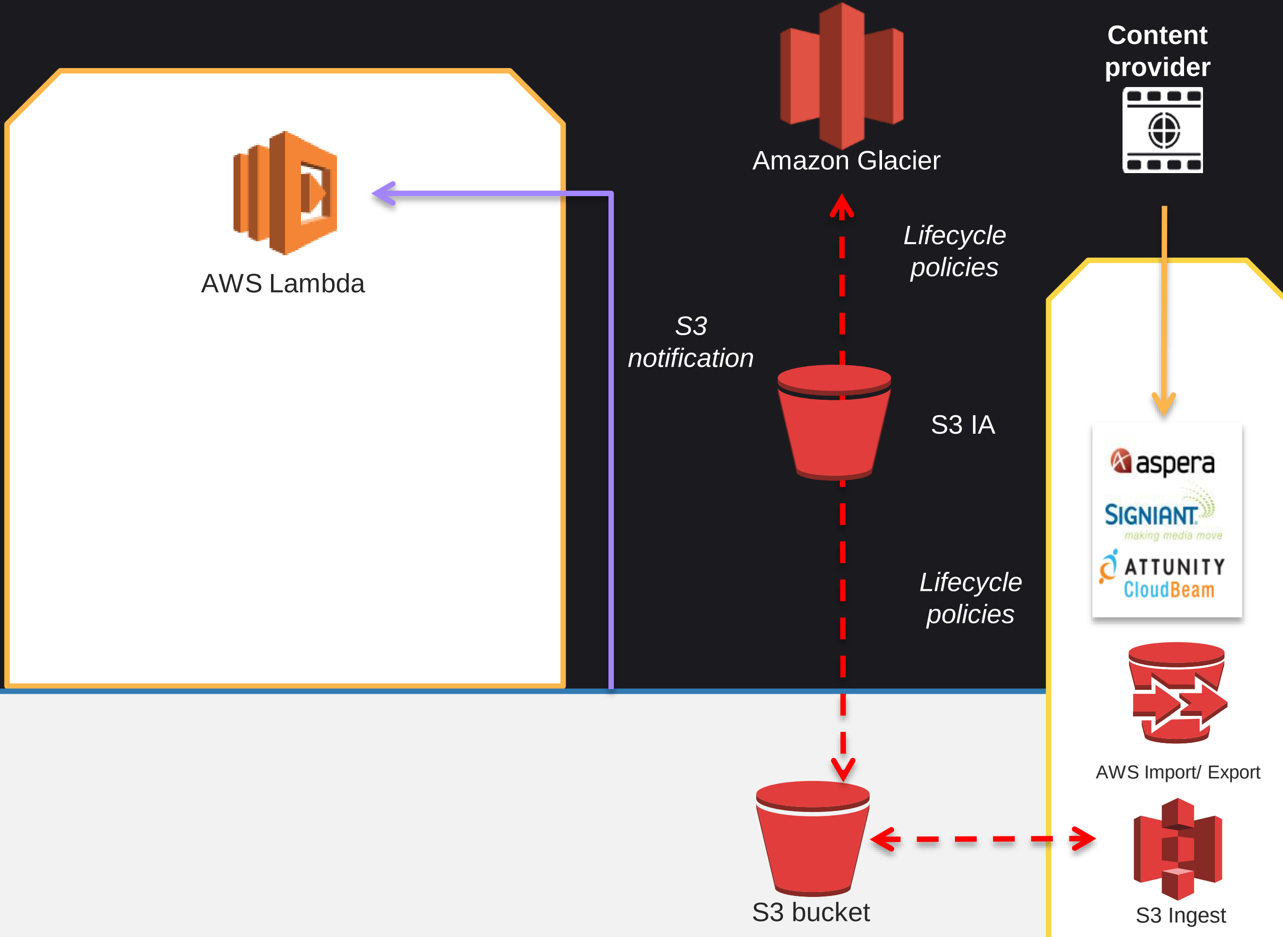

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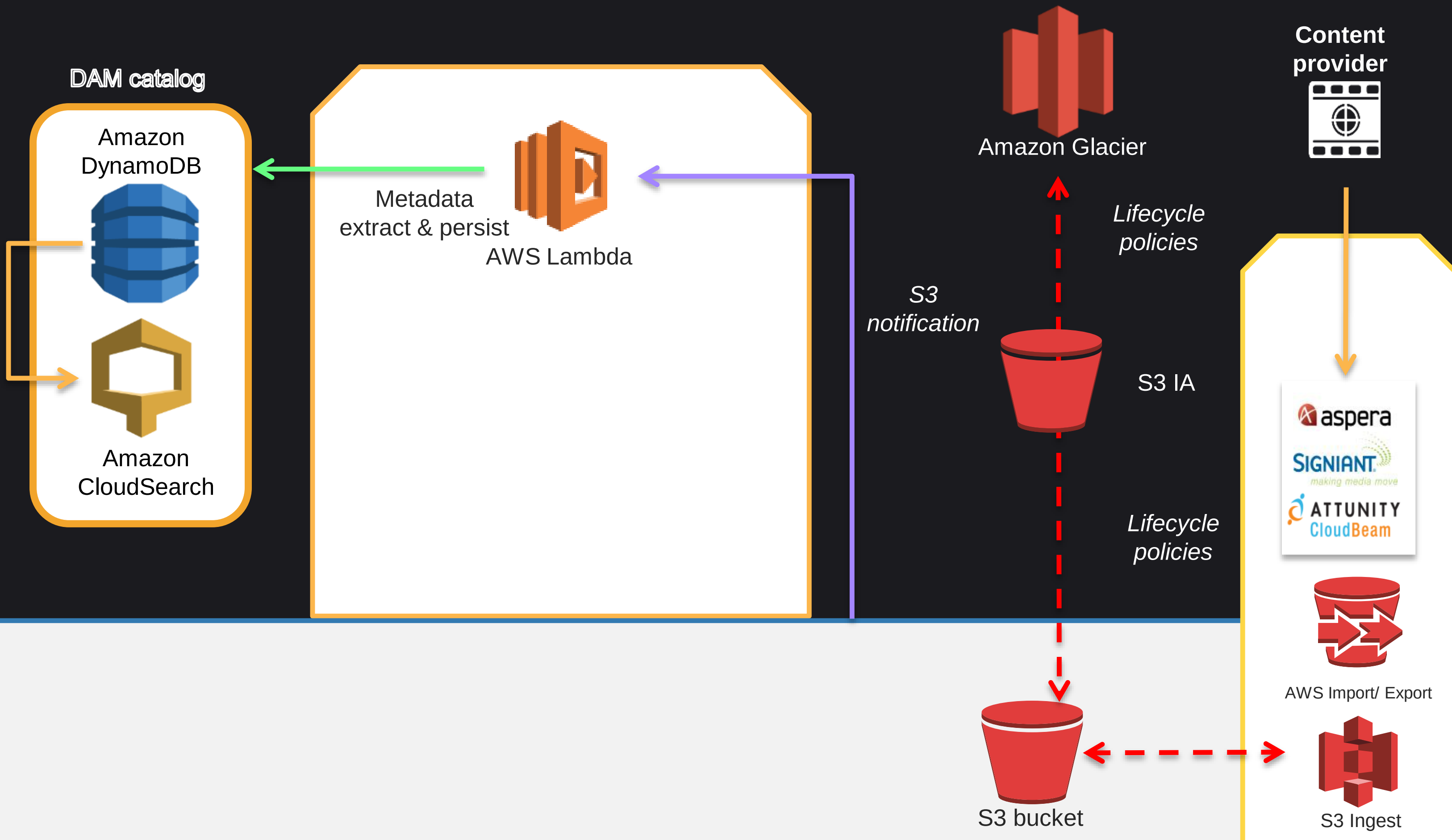

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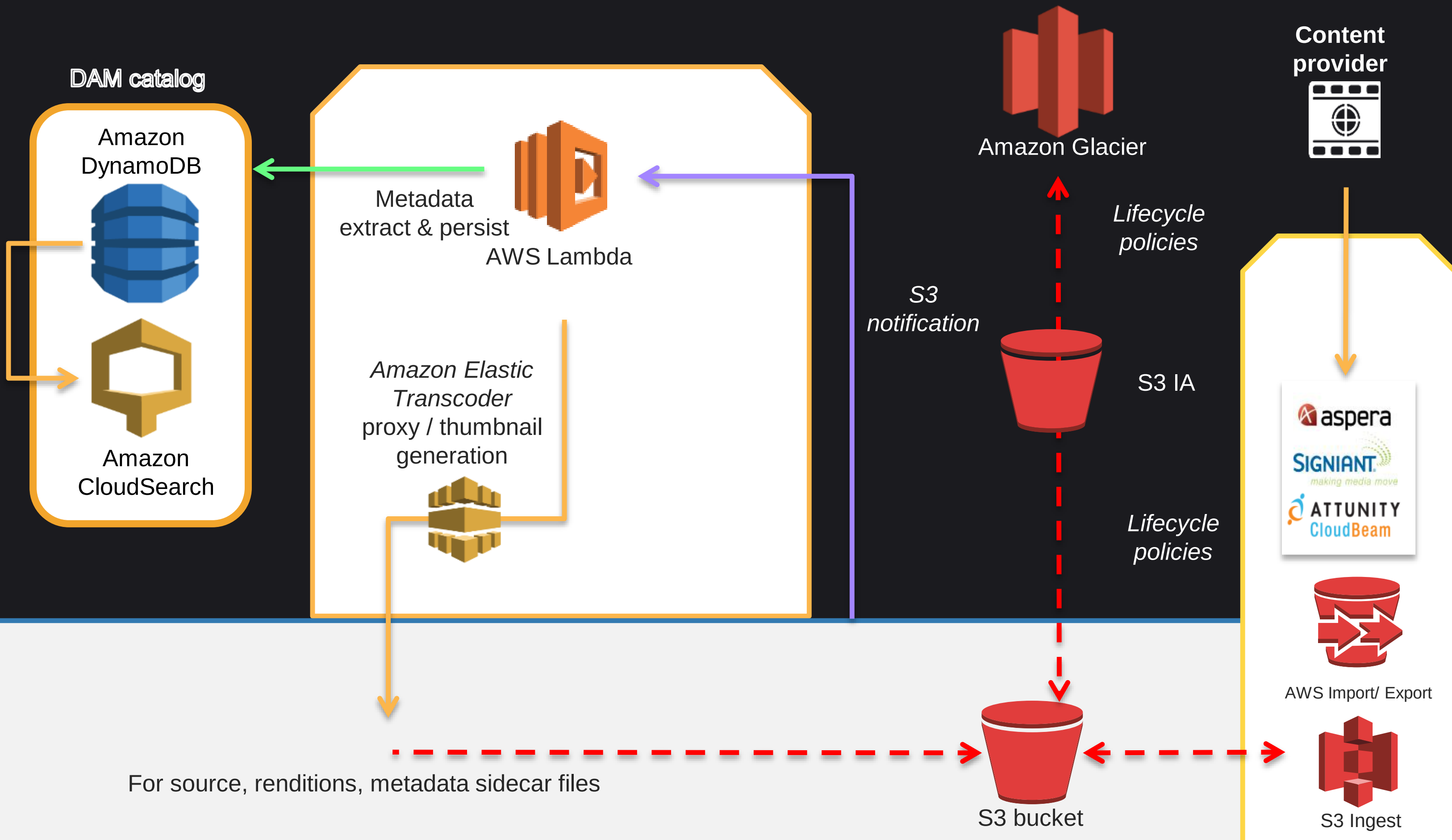

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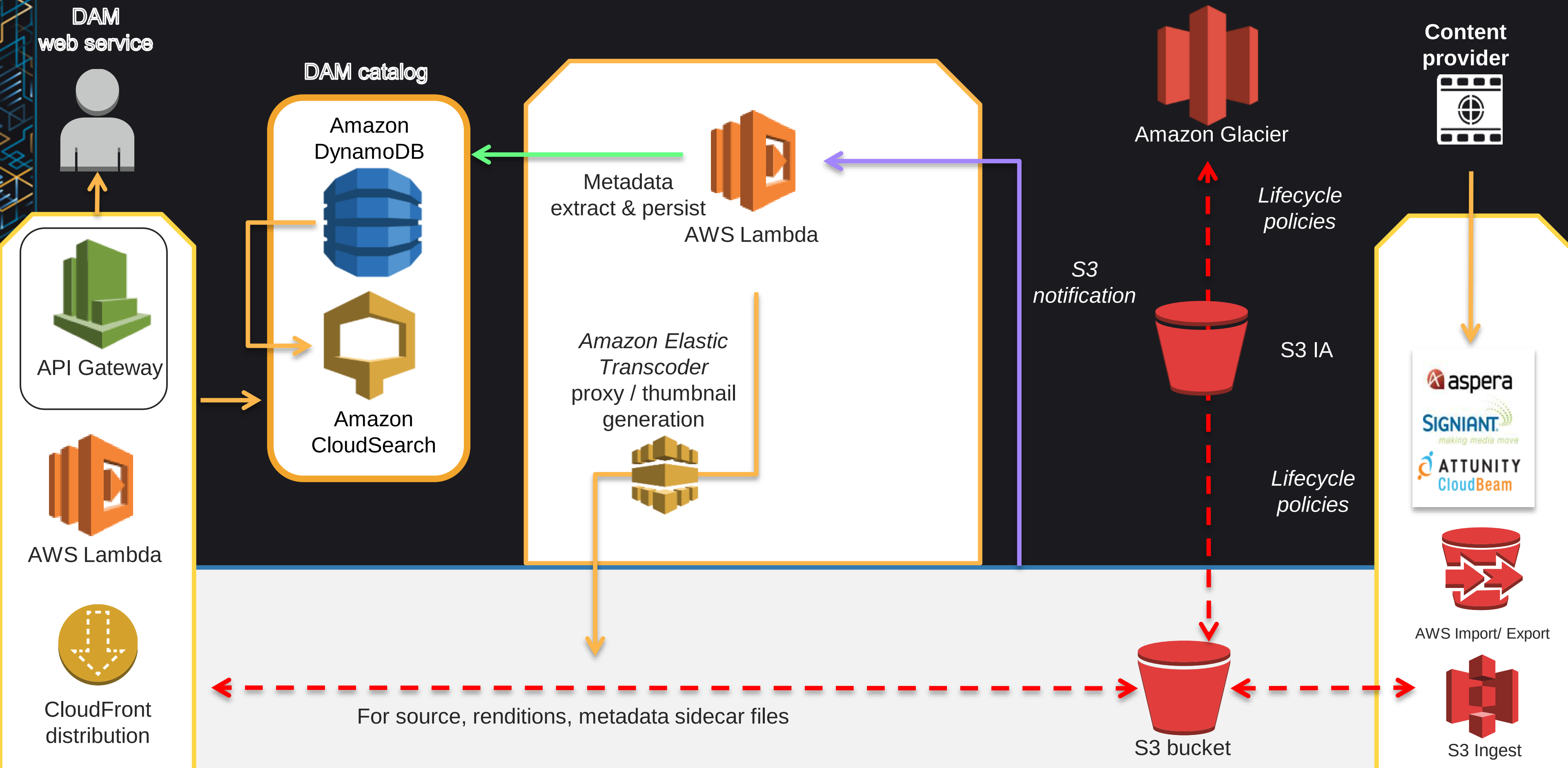
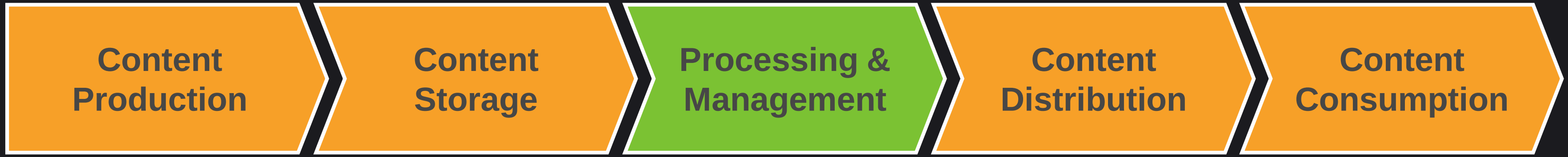



Content Production
Content Storage
Processing & Management
Content Distribution
Content Consumption

Encoding, Packaging, Encrypting

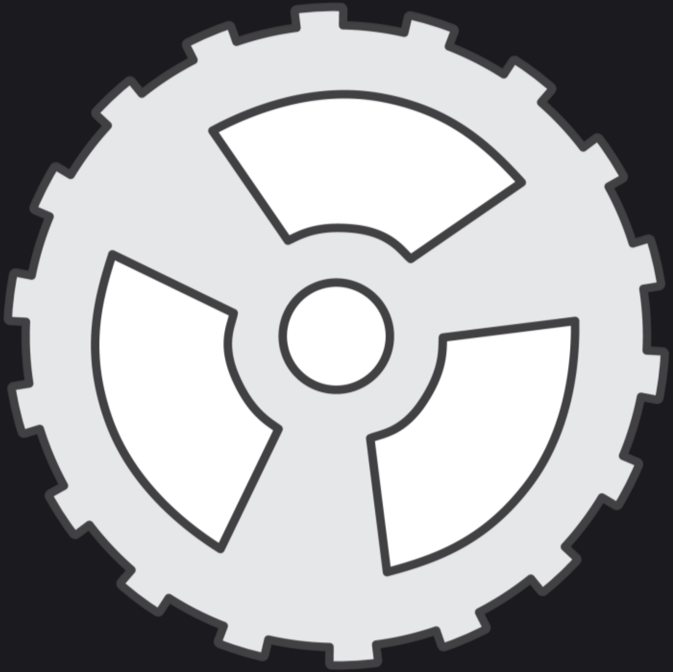
Challenges

Multiple client devices

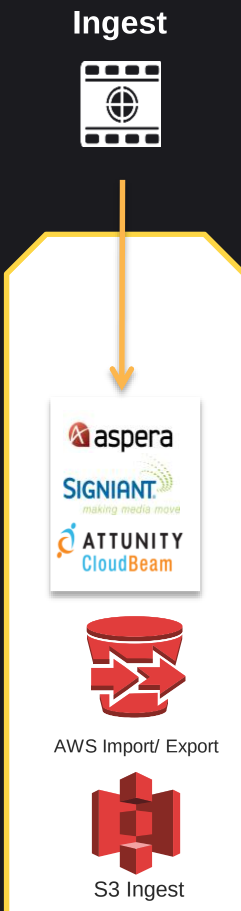
Higher quality content

Parallel, complex workflow

Uneven load distribution



Content Processing Pipeline (Using Lambda)



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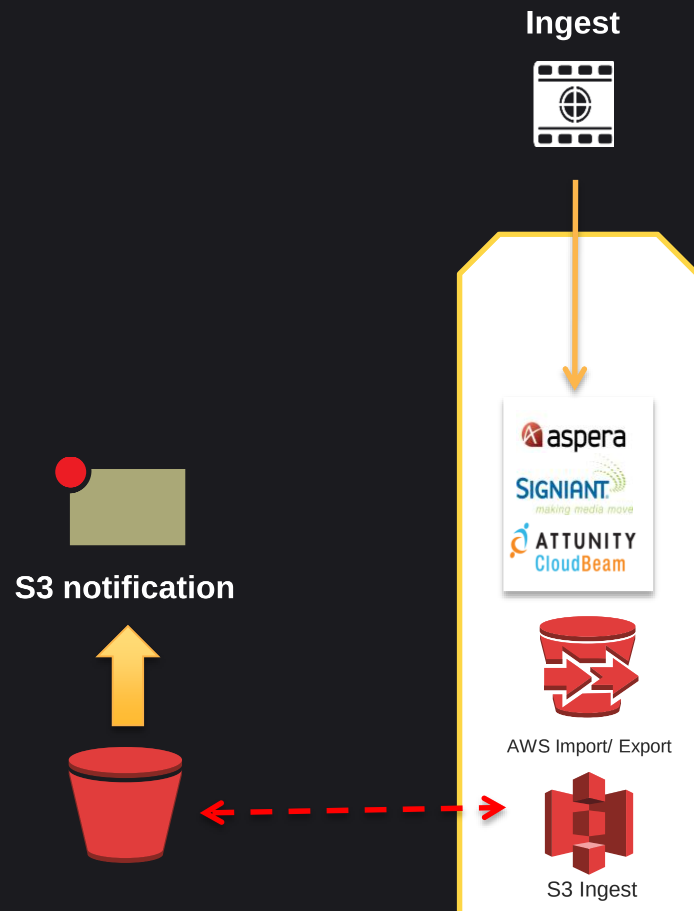

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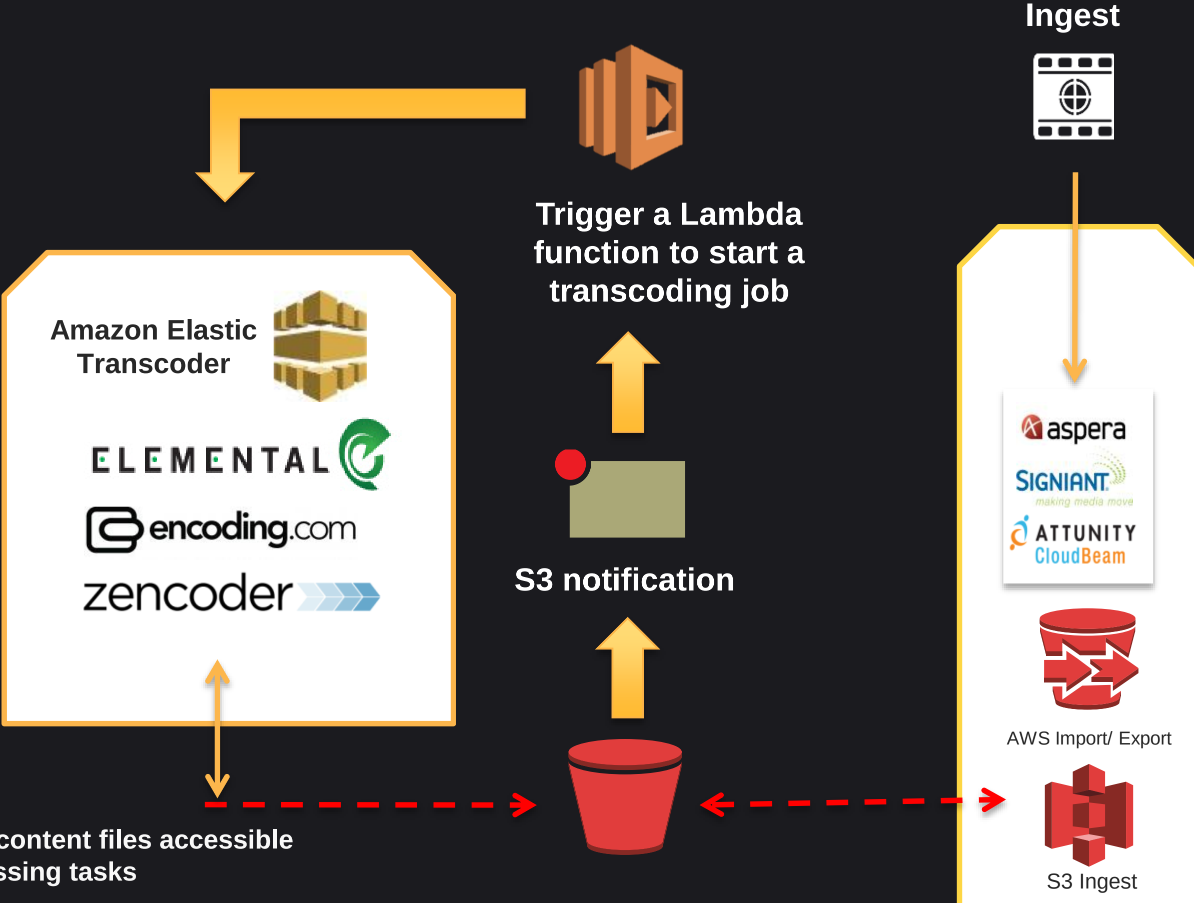
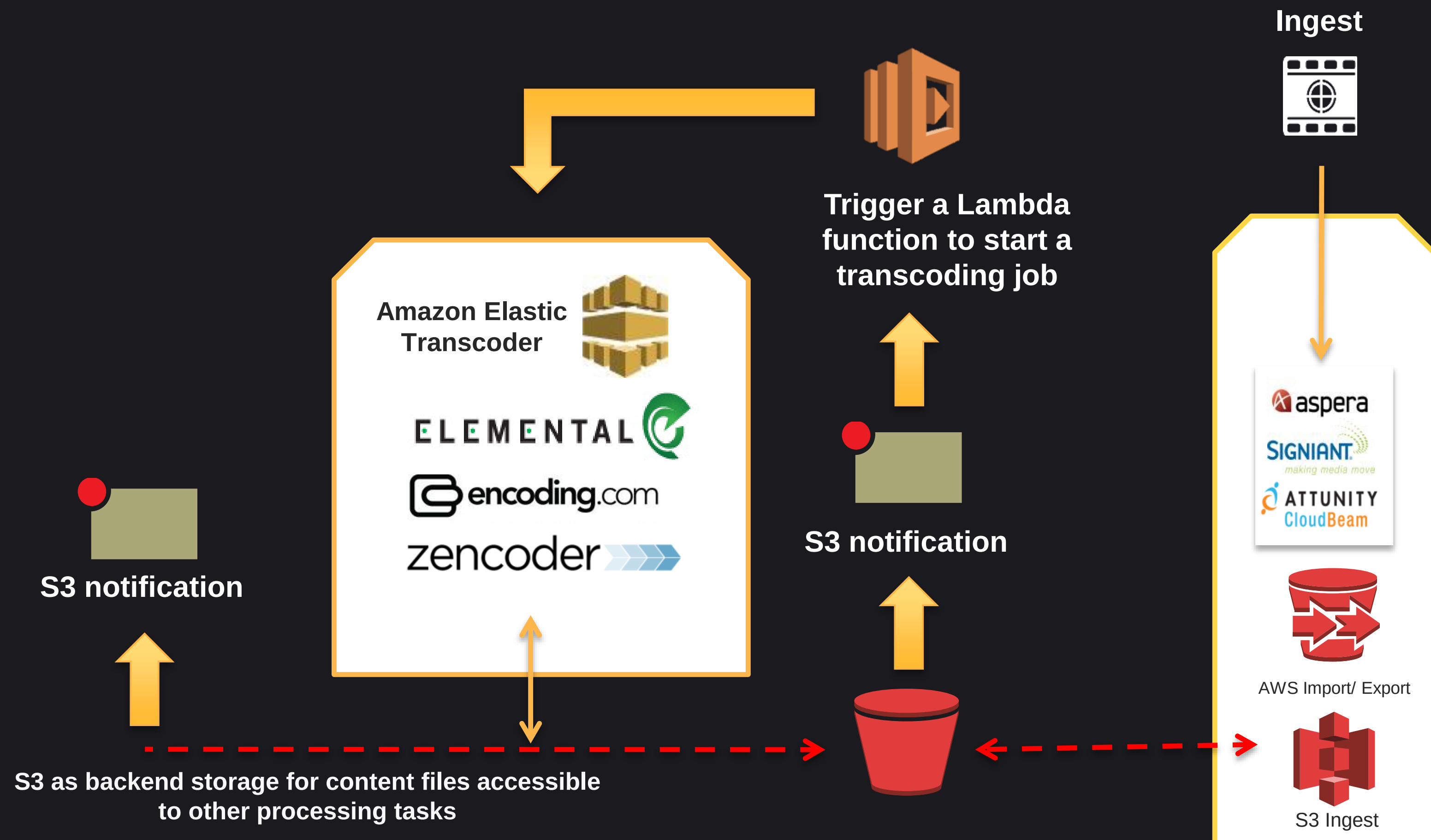


S3 as backend storage for content files accessible to other processing tasks

Content Processing Pipeline (Using Lambda)


Ingest
Trigger a Lambda function to start a transcoding job
Amazon Elastic Transcoder
ELEMENTAL
encoding.com
zencoder
S3 notification
S3 notification
aspera
SIGNIANT making media move
ATTUNITY CloudBeam
AWS Import/ Export
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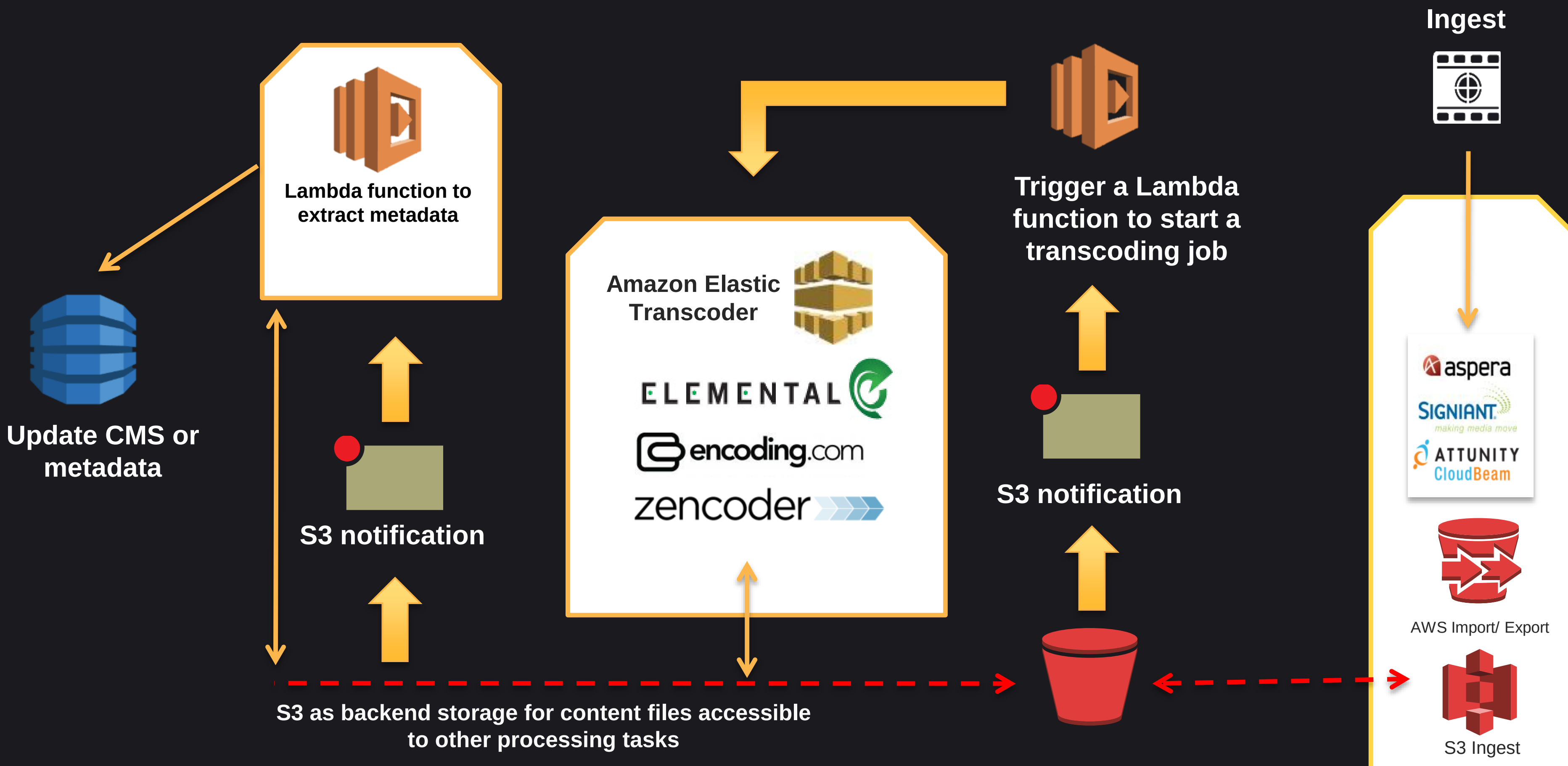
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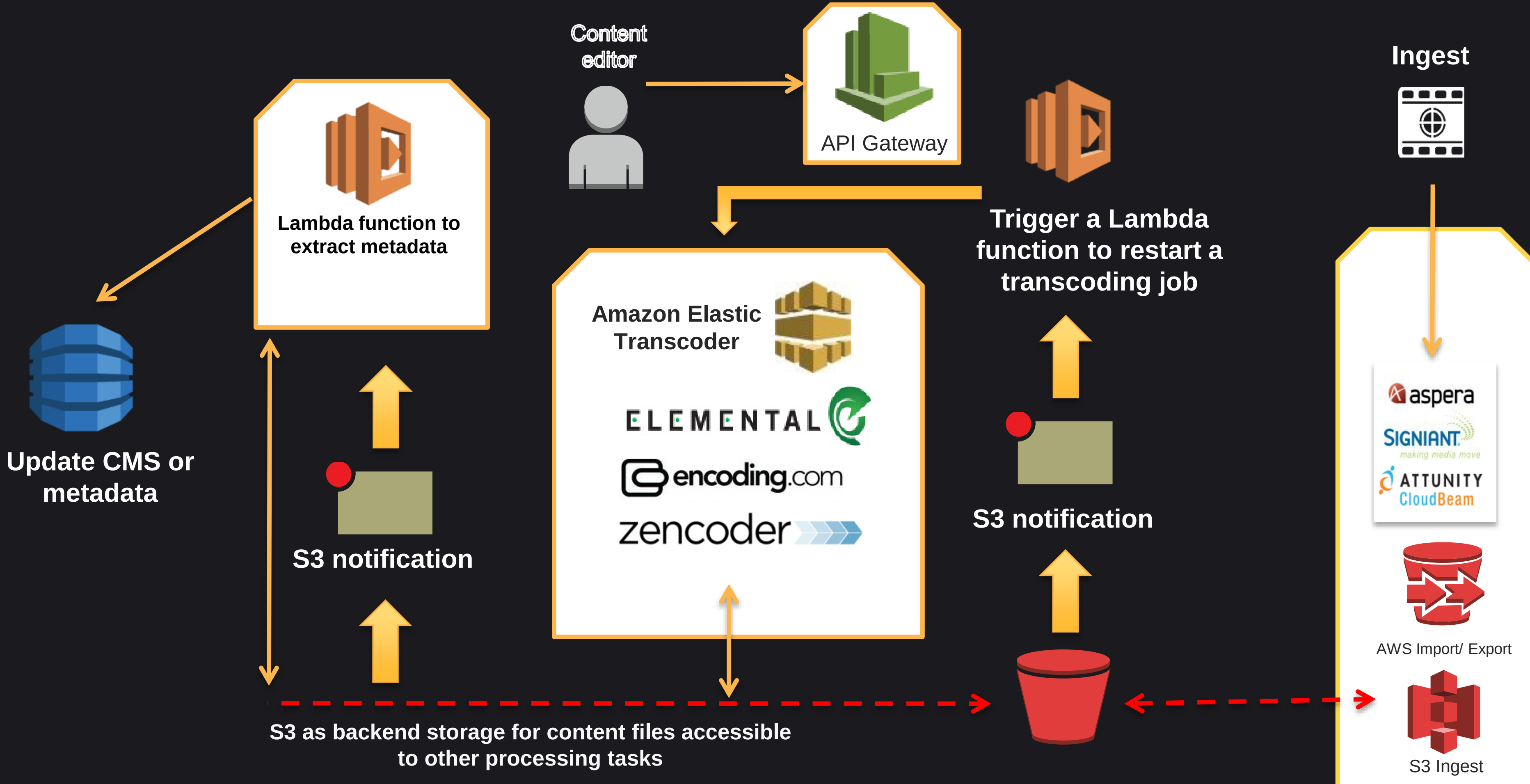
Content editor
API Gateway
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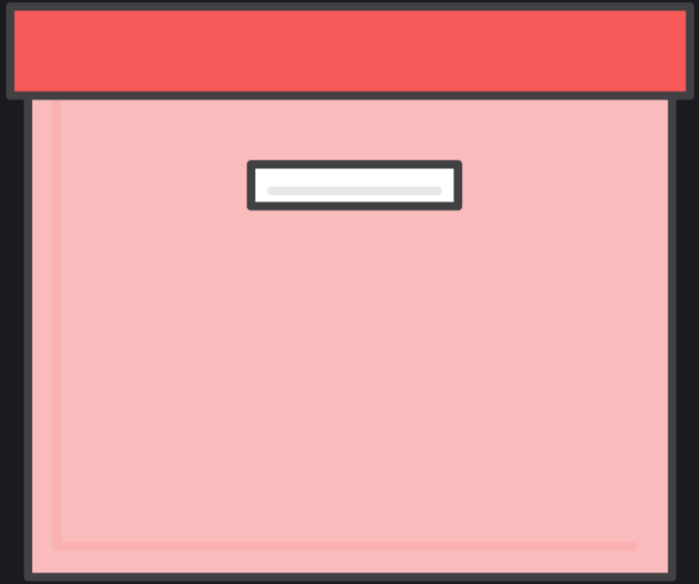
What About Packaging?

All moving towards HTTP – RTMP is hard to scale

Battle of the standards – HLS, HDS, SmoothStream, MPEG-DASH

Alliance for Open Media



And Encryption / DRM?

Still largely driven by studio requirements

Just-in-time encryption (hard)

Reusability across packaging methods (PlayReady across HLS & SmoothStream)

Pitfalls of Content Prep

Betting big on closed standards

Technologies in vogue

Adoption is device-driven

Avoiding Pitfalls of Content Prep

Keep your mezzanine / masters (S3 IA, Glacier)

Mix and match your encoding

Contradictory — JIT packaging and heavy caching

Remember 80/20 (95/5) rule of content

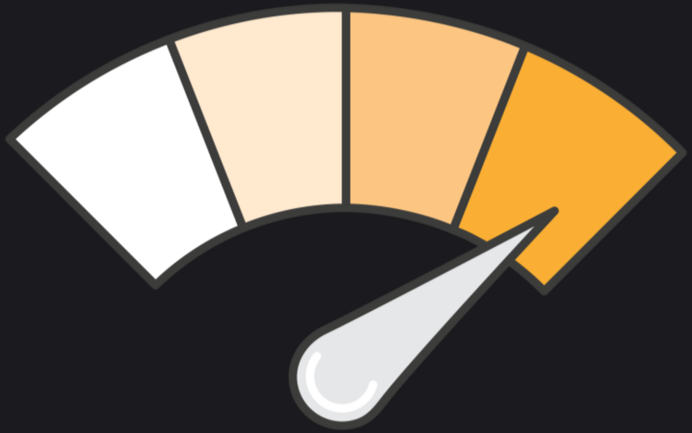
Top Tip

CPU-based encoding

c4.8xlarge / m4.10xlarge

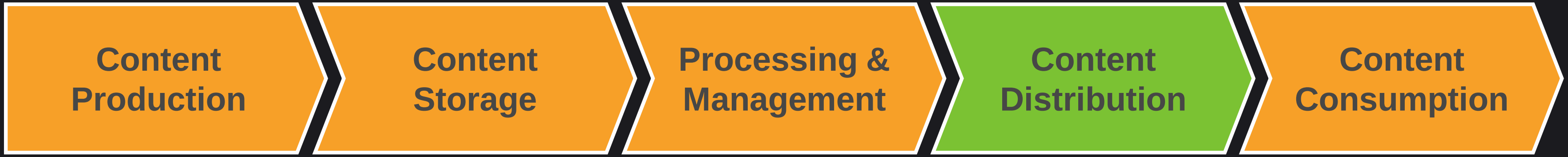
P-State, C-State configuration

Varies with particular encoding libraries – experiment and baseline



(Thanks PocketMath!)

pocketmath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Content Delivery Architectures

Live

RTMP ingest to origin

Repackaged and encrypted on the fly

DRM less common

WebRTC for 1-to-few, then RTMP/HTTP when traffic increases

VOD / Catchup

File-based – stored on S3/CDN

Usually prepared (encrypted/packaged) before final storage

DRM by default

ISPs worried about unicast delivery

HTTP Live Streaming (HDS & HLS)

HLS was pretty close to de facto

Space becoming disrupted again

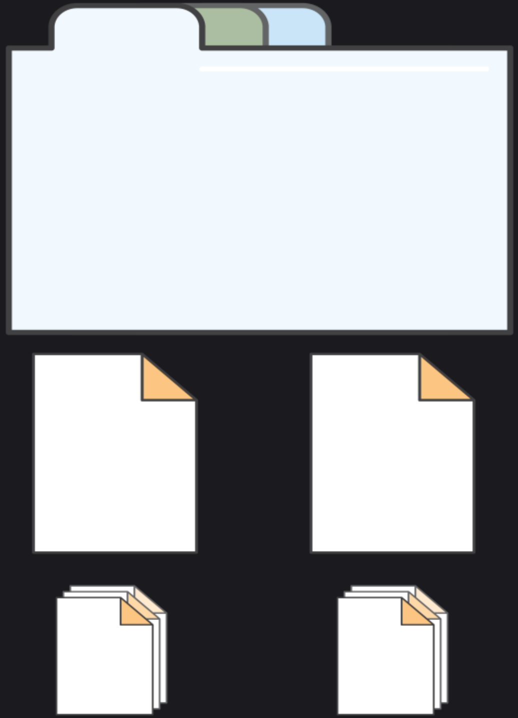
Network considerations in the real world

HLS and HDS

Uses “parent / child / chunk” model

HLS: Playlist contains chunklists, which contain chunks

HDS: Manifest contains bootstrap files, which contain fragments



HTTP Dynamic Streaming — HDS

```
> GET /live/channel1.abst HTTP/1.1

< Seg1-Frag55
< Seg1-Frag56

[…]

> GET /live/channel1.abst HTTP/1.1
< Seg1-Frag1
< Seg1-Frag2
```

HTTP Dynamic Streaming — HDS

Use fragment name alignment in the event of a republish

Ensure that fragments are aligned **across bitrates**

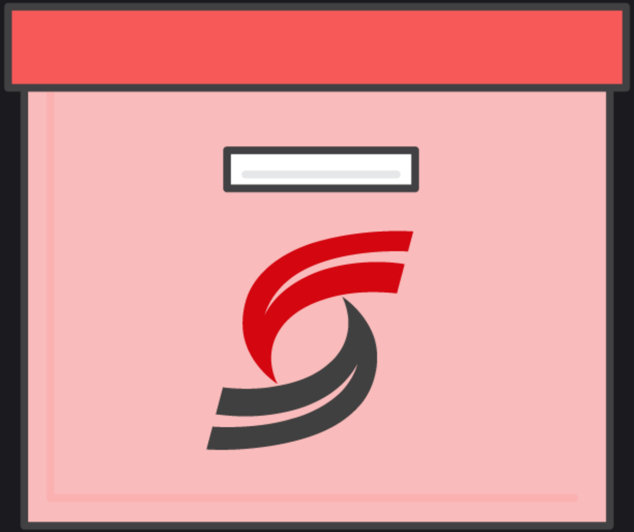
Players will error otherwise

Top Tip

HDS bootstraps are binary

To view, you must decode them first

https://bitly.com/abstdecoder



(Thanks SwiftServe!)

HTTP Live Streaming — HLS

```
> GET /live/channel1.m3u8 HTTP/1.1

< HTTP/1.1 200 OK
< Date: Tue, 15 Sep 2015 13:37:56 GMT
< Server: Apache
< Last-Modified: Mon, 03 Aug 2015 3:14:15 GMT
< Accept-Ranges: bytes
< Content-Length: 219
```

HTTP Live Streaming — HLS

```
> GET /live/channel1.m3u8 HTTP/1.1

< HTTP/1.1 200 OK
< Date: Tue, 15 Sep 2015 13:37:56 GMT
< Server: Apache
< Last-Modified: Mon, 03 Aug 2015 3:14:15 GMT
< Accept-Ranges: bytes
< Content-Length: 219
< Cache-Control: max-age=5
```

HTTP Live Streaming

Add a no, or short age, cache header

Use segment name randomisation

Use Player metrics to detect problem ISPs / CDNs

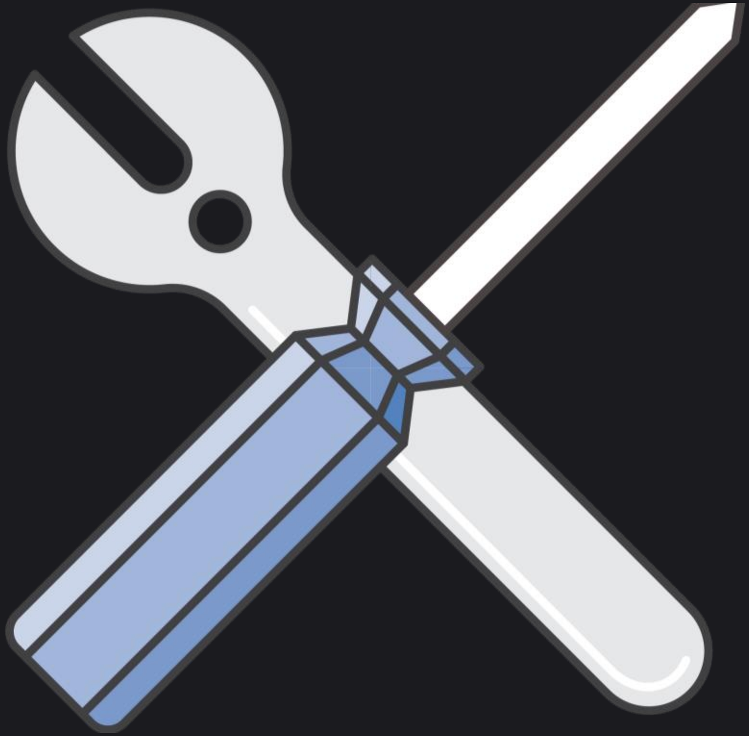
Multi-CDN

CDN Selector

Build vs. buy

Excellent offerings on the market

Metadata often tightly coupled with platform, so tricky to use a third party



CDN Selection Methods

DNS-based

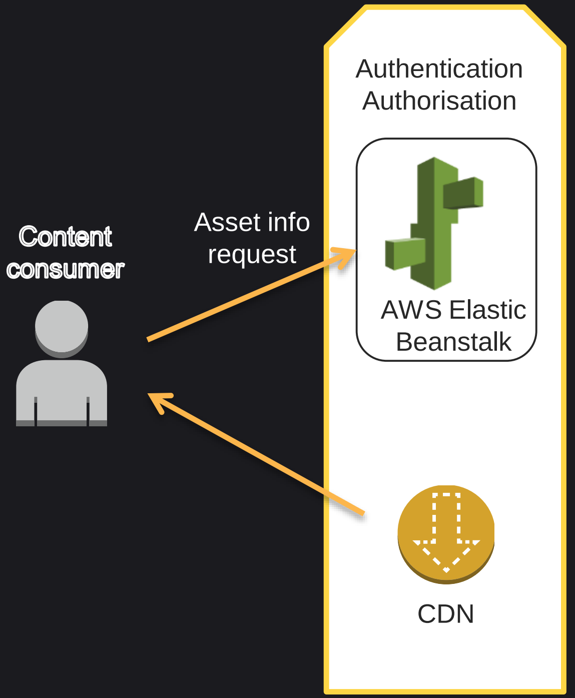
- Geo / latency / intelligent routing at DNS level

Asset sharding

- 50% of assets on CDN A, 50% on CDN B

CDN-aware asset info service

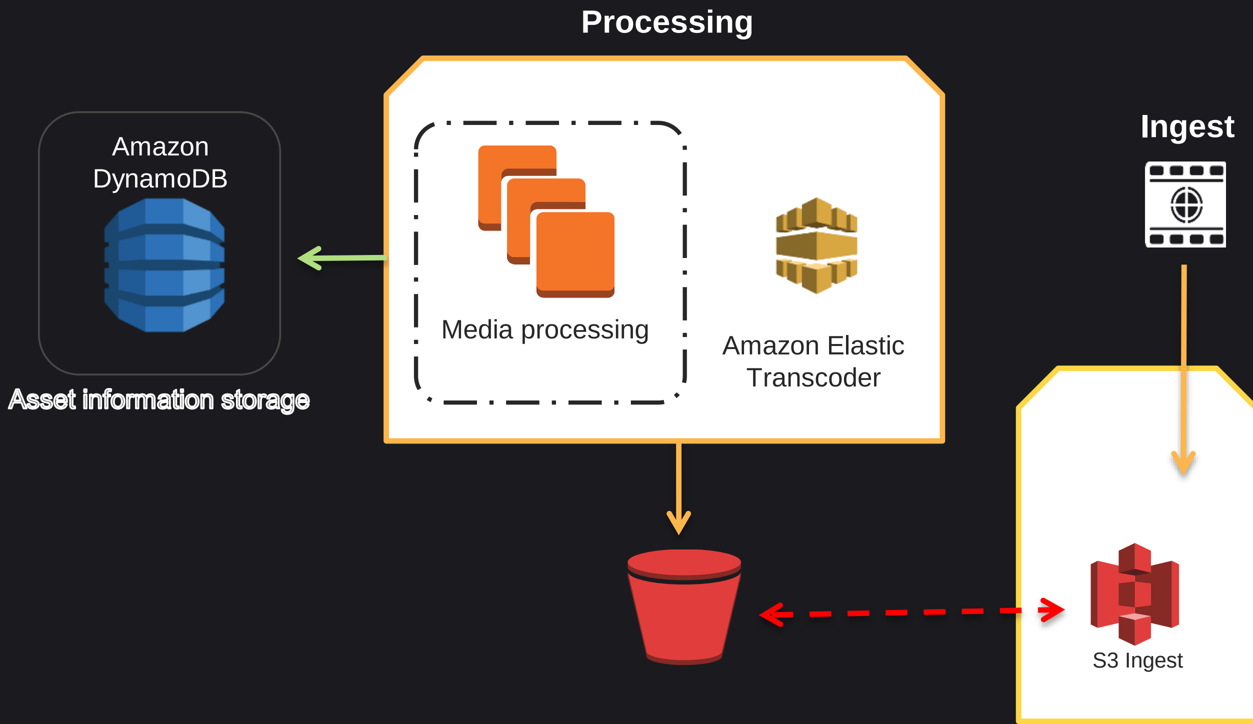
CDN-aware Asset Info Service



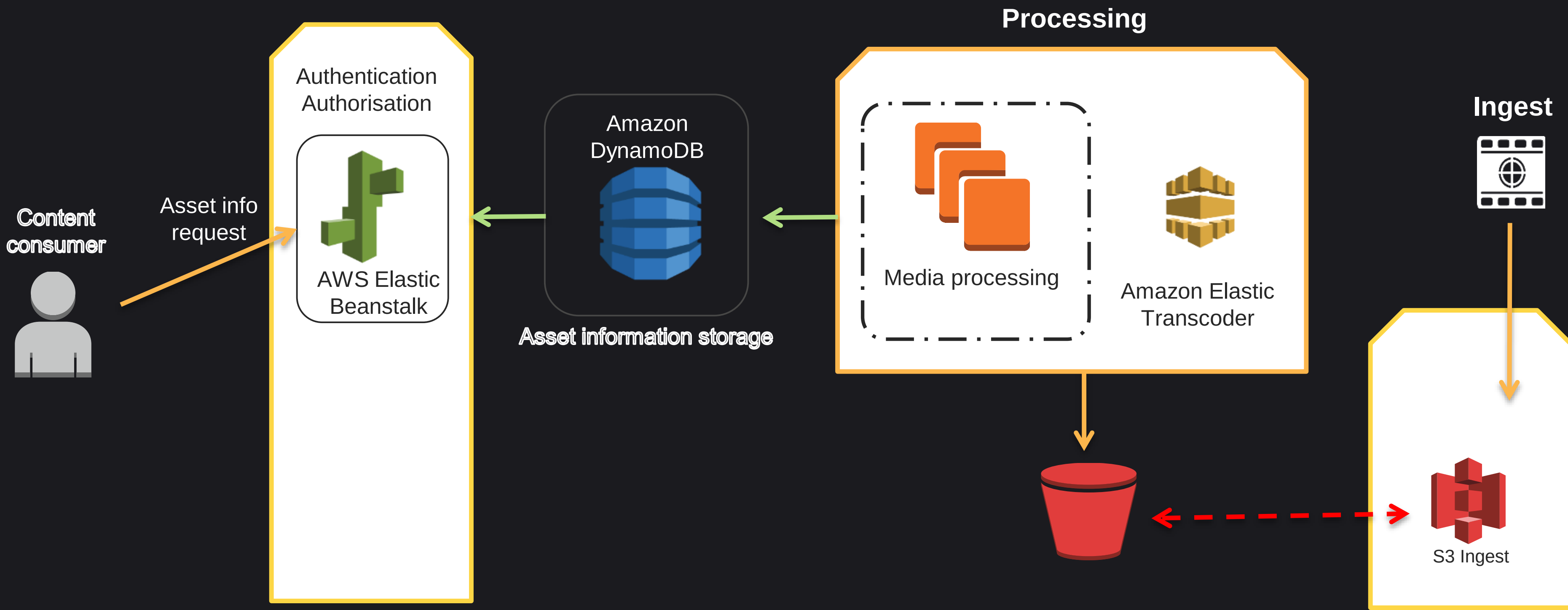
CDN-aware Asset Info Service

```
> GET /asset/31337 HTTP/1.1




< assetUrl: "http://cdn-a.alexjs.im/vod/31337.m3u8"
< adProvider: "alexjsAds"
< countryCode: "[im, sg, id]"
```

CDN-aware Asset Info Service



CDN-aware Asset Info Service



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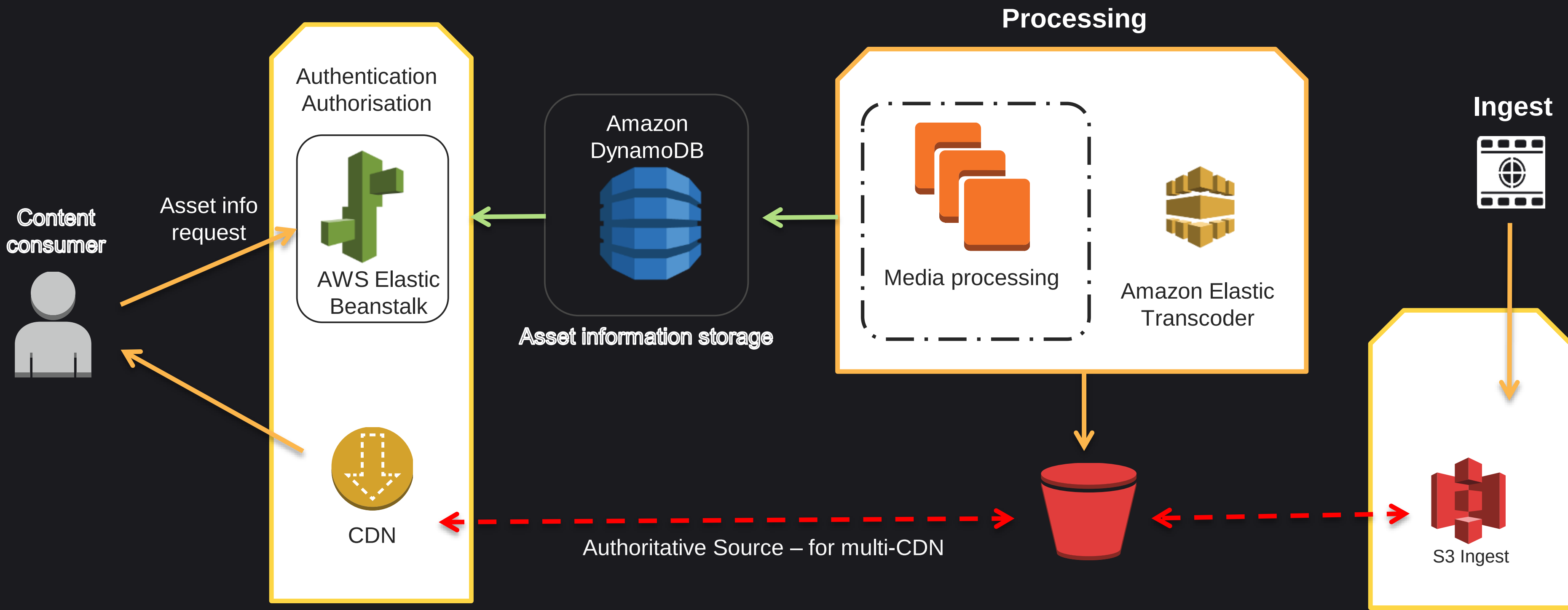
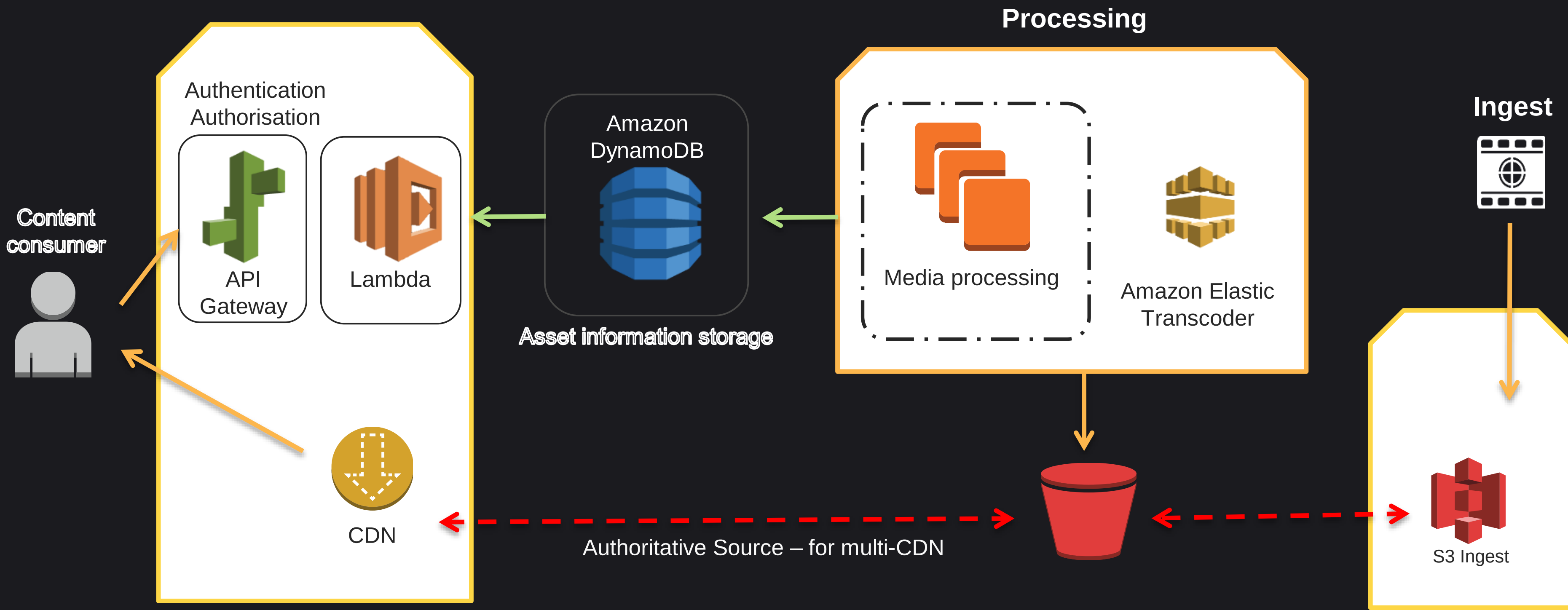
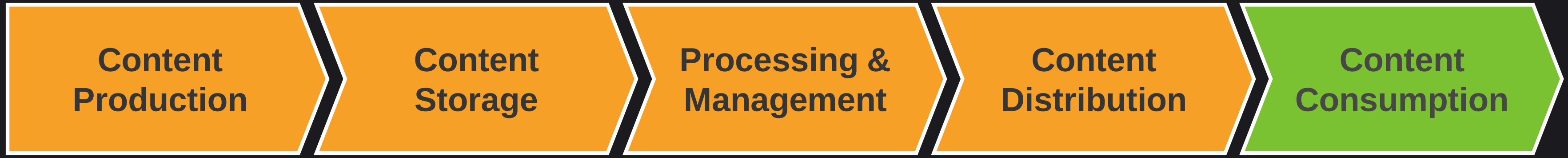


CDN-aware Asset Info Service

Perfect for microservices – and for serverless computing

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Concurrency Management (and More)

Concurrency

Problem

Studio mandate on stream concurrency

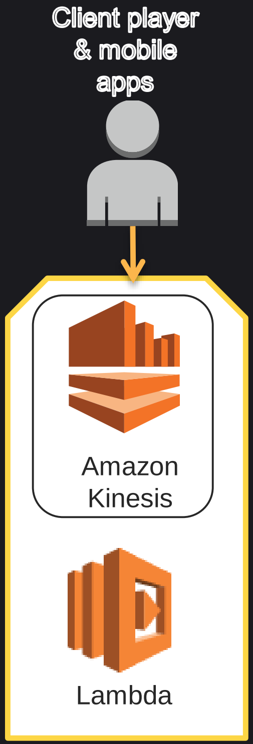
Cross-account sharing

Approach

Player heartbeat

Subscription-based thresholds

Subscriber Concurrency Management



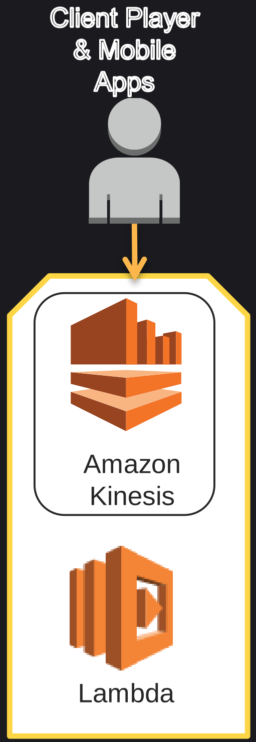
Heartbeat sent from every player at regular intervals

Supports both native and web-based players

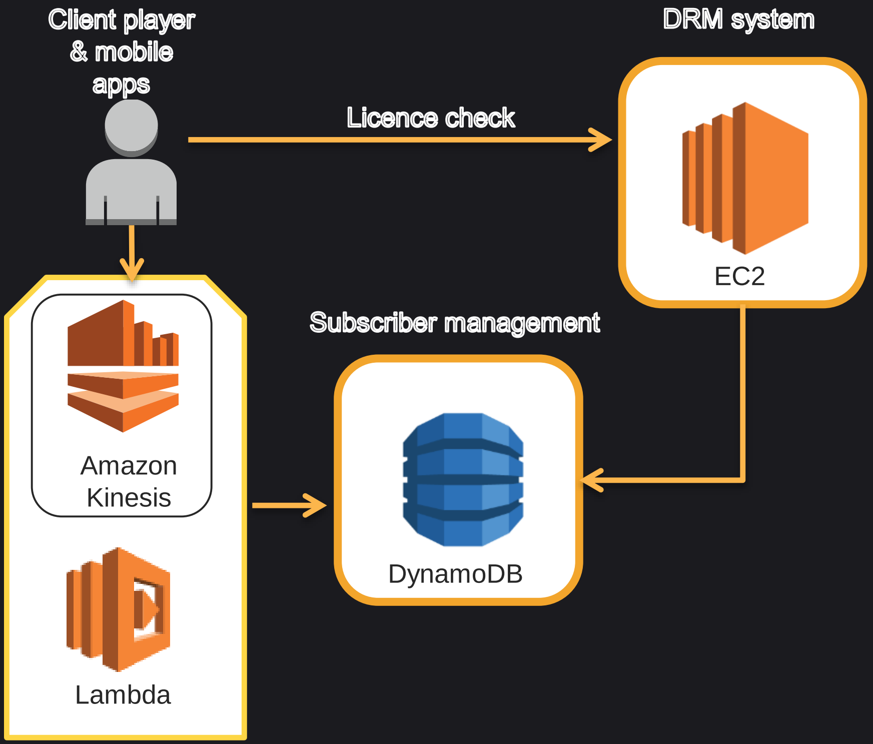
Subscriber Concurrency Management

```
{
   assetId: "d6f9fe" // Programme ID
   userId:   "33114220875dc" // Token / User
ID timeStamp: "T00:00:05" // Progress
   deviceId: "93d2d4fef95cb" // Fingerprint
   deviceType: "Amazon Fire" // From API
}
```

(Pseudo JSON)



Subscriber Concurrency Management



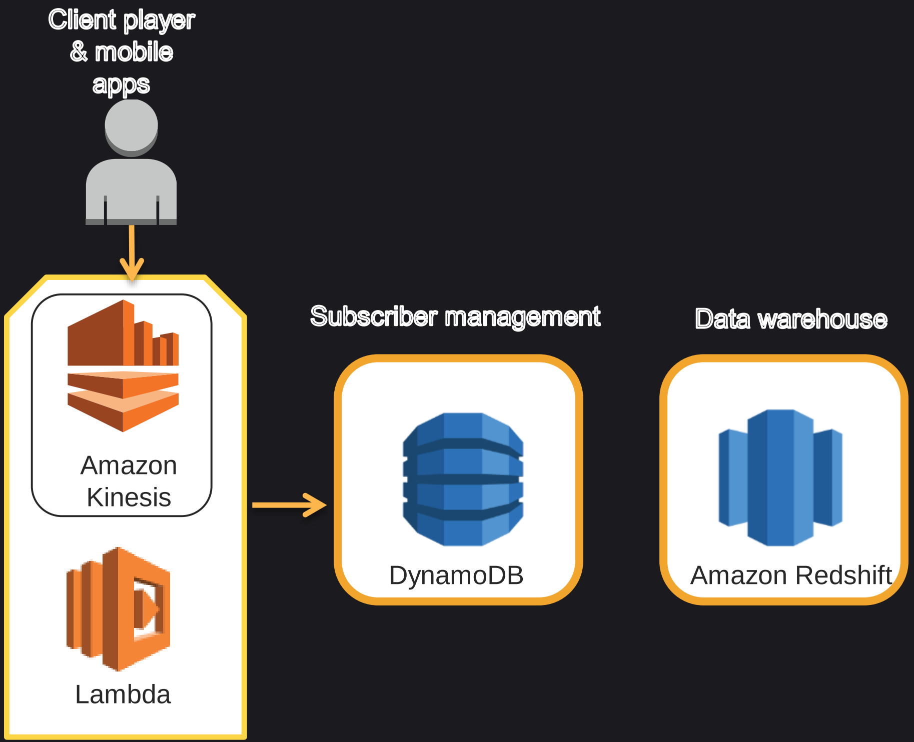
Heartbeat received by Amazon Kinesis

Data fed into DynamoDB

DRM licence server reads DynamoDB table

Decision made

Subscriber Concurrency Management

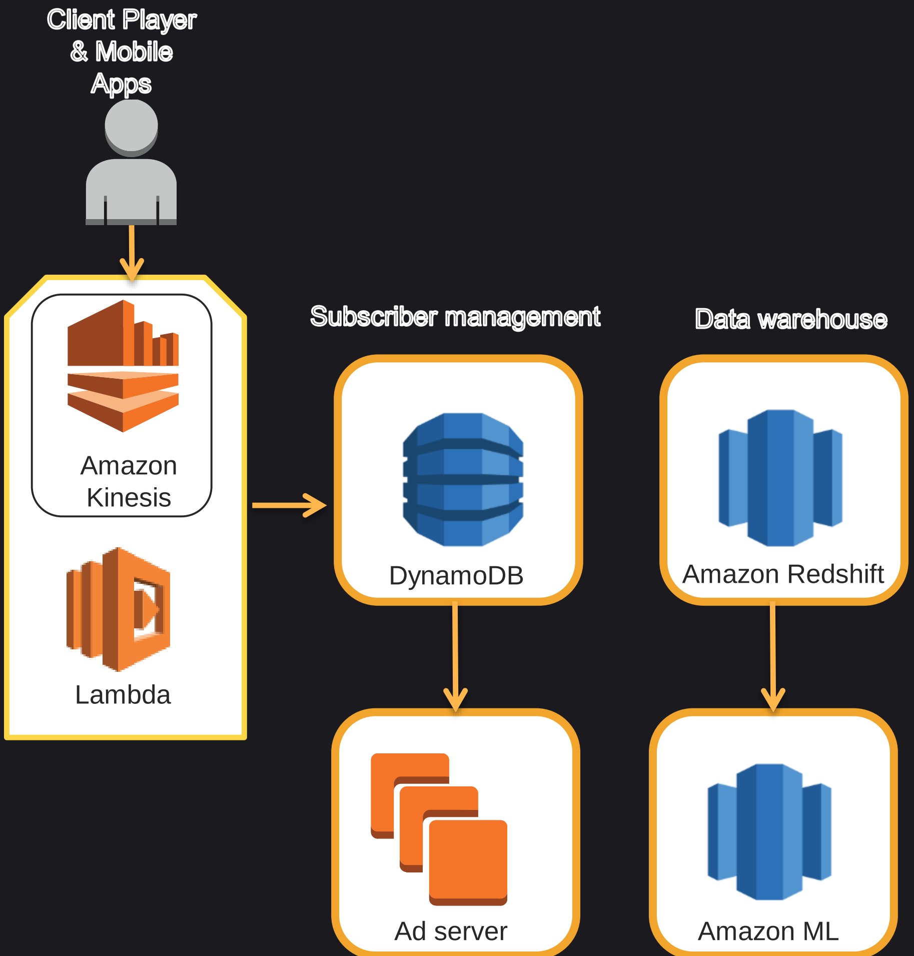


Track drop-off

Highlight popular content

Feed back into content development

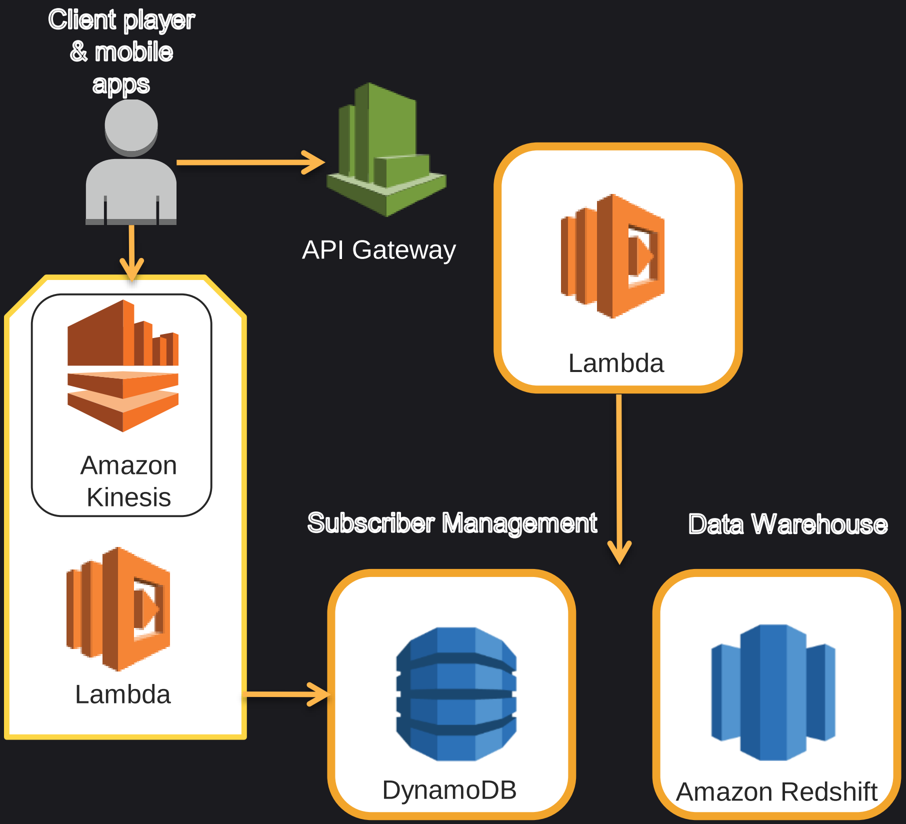
Subscriber Concurrency Management



Syndicate data to ads server

Recommendations-based demographic

Subscriber Concurrency Management



Cross-device

Play / pause / resume

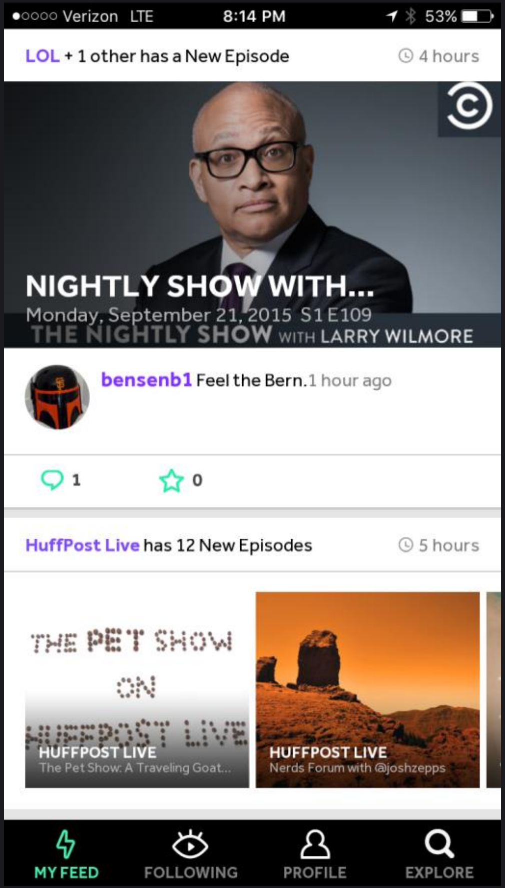
No servers needed

Client-side "stop" can be enabled, too (non-DRM based)

Go90 — Verizon

Go90

go90.com, #go90


●○○○○ Verizon LTE 8:14 PM 53%

LOL + 1 other has a New Episode 4 hours

NIGHTLY SHOW WITH...
Monday, September 21, 2015 S1 E109
THE NIGHTLY SHOW WITH LARRY WILMORE

bensenb1 Feel the Bern. 1 hour ago

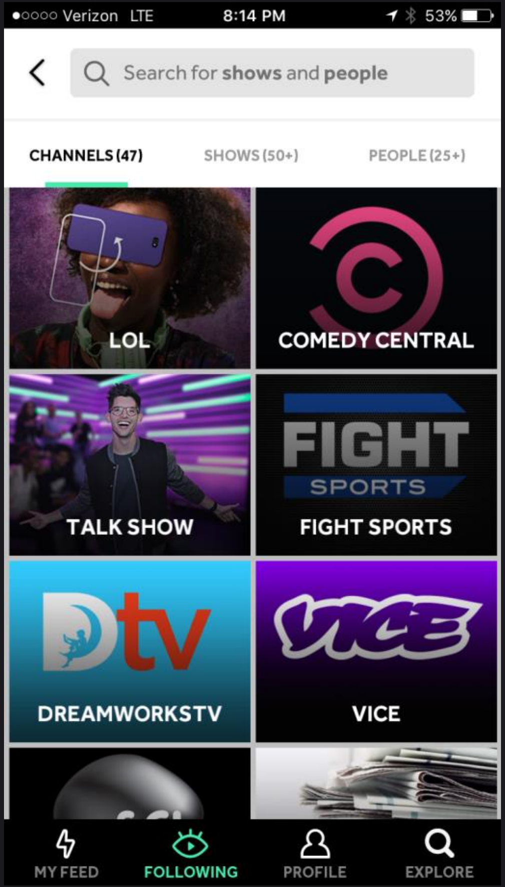
1 0

HuffPost Live has 12 New Episodes 5 hours

HUFFPOST LIVE
The Pet Show: A Traveling Goat...

HUFFPOST LIVE
Nerds Forum with @joshzepps

MY FEED FOLLOWING PROFILE EXPLORE

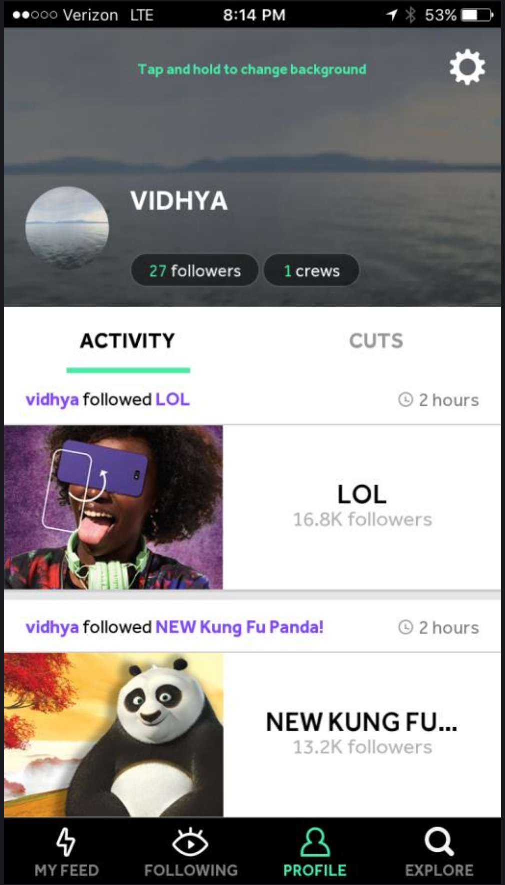

●○○○○ Verizon LTE 8:14 PM 53%

Search for shows and people

CHANNELS (47) SHOWS (50+) PEOPLE (25+)

LOL
COMEDY CENTRAL
TALK SHOW
FIGHT SPORTS
DREAMWORKSTV
VICE

MY FEED FOLLOWING PROFILE EXPLORE


●●○○○ Verizon LTE 8:14 PM 53%

Tap and hold to change background

VIDHYA

27 followers 1 crews

ACTIVITY CUTS

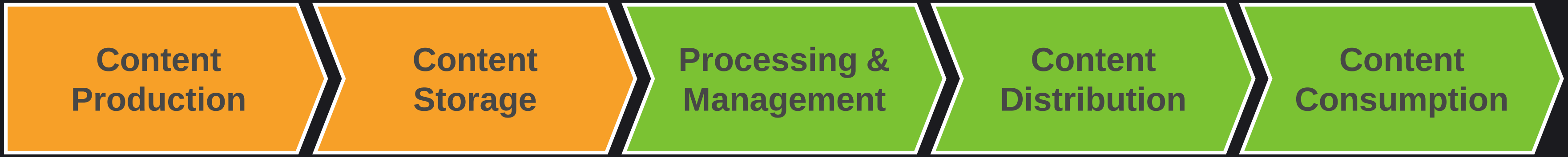
vidhya followed LOL 2 hours

LOL
16.8K followers

vidhya followed NEW Kung Fu Panda! 2 hours

NEW KUNG FU...
13.2K followers

MY FEED FOLLOWING PROFILE EXPLORE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Go90 — from 30,000 ft

100+ micro services/systems

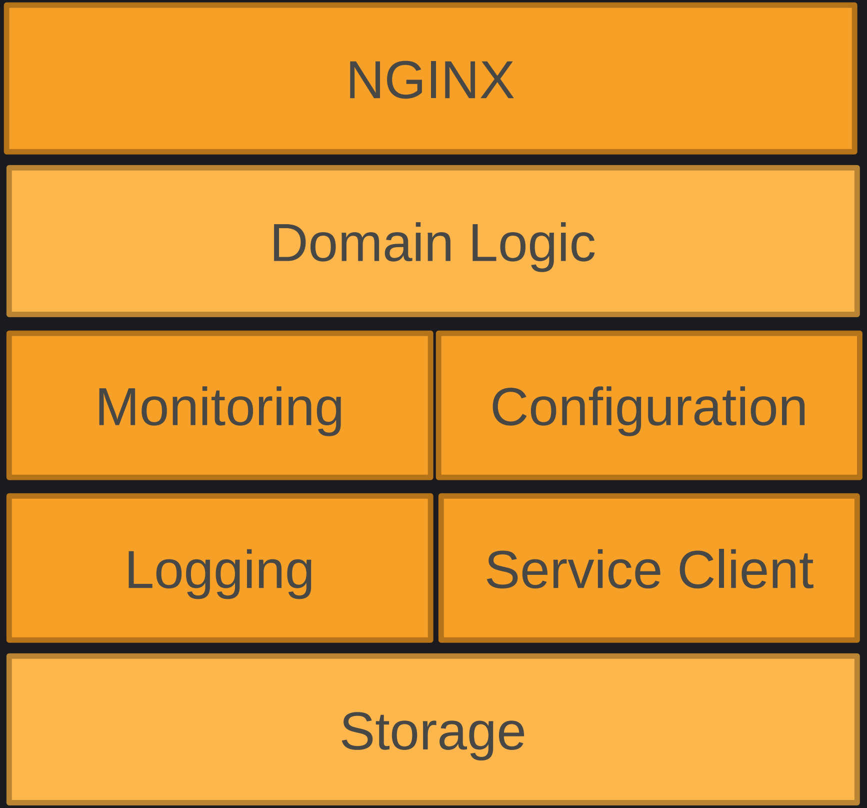
10+ deployments per week

Multiple clients, large target user base

High reliability/availability, low latency, superior user experience

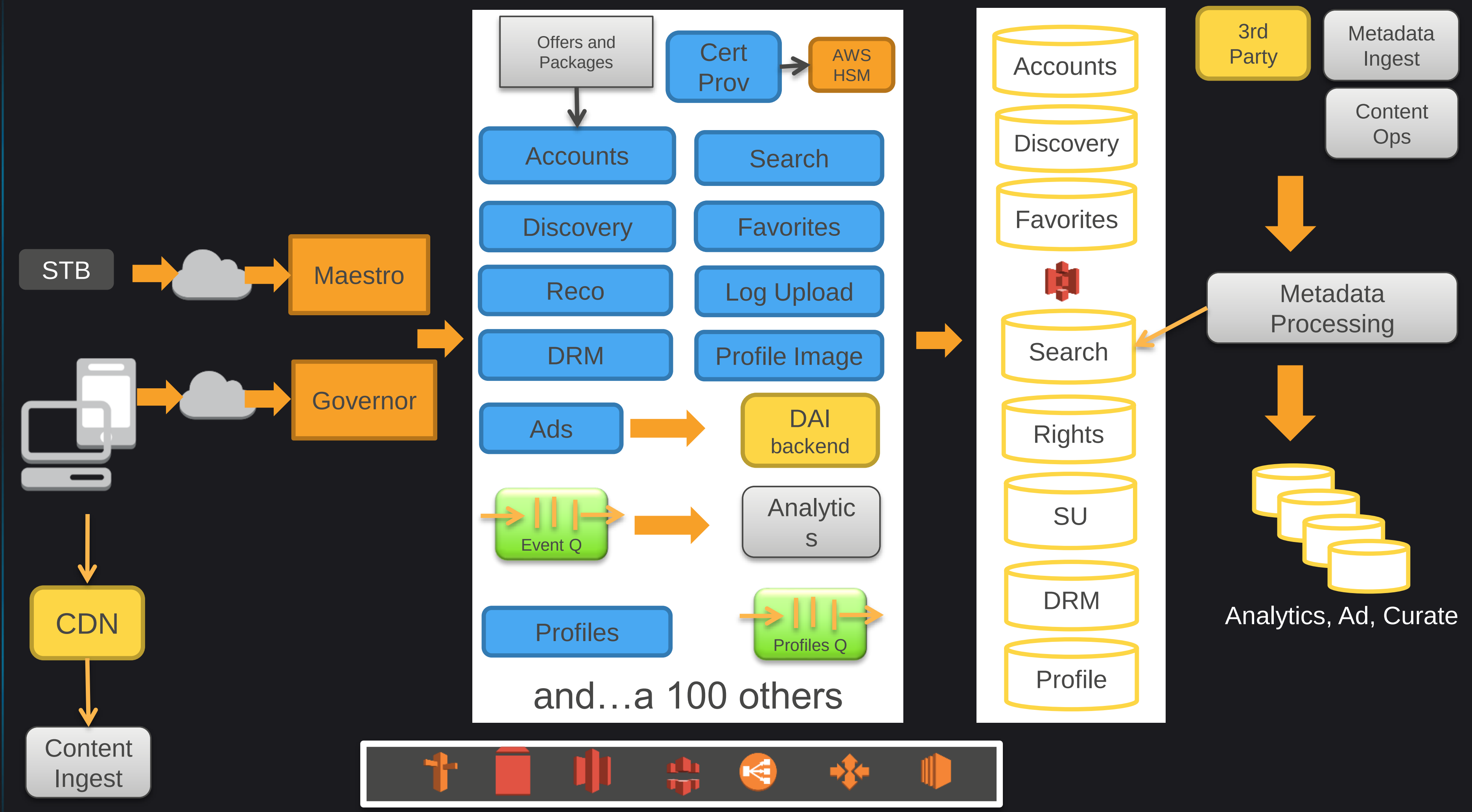
APIs — Edge Services

Typical Service Stack

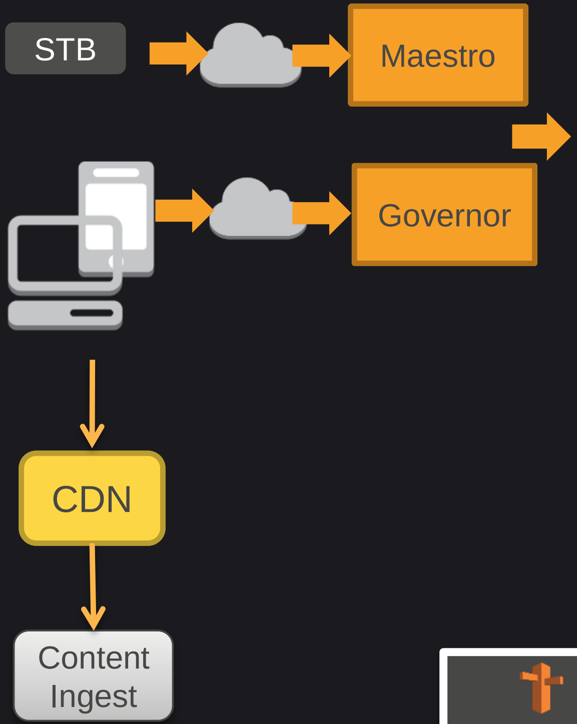


verizon

https://github.com/oncue



STB
Maestro
Governor
CDN
Content Ingest
Offers and Packages
Cert Prov
AWS HSM
Accounts
Search
Discovery
Favorites
Reco
Log Upload
DRM
Profile Image
Ads
DAI backend
Event Q
Analytics
Profiles
Profiles Q
and…a 100 others
Accounts
Discovery
Favorites
Search
Rights
SU
DRM
Profile
3rd Party
Metadata Ingest
Content Ops
Metadata Processing
Analytics, Ad, Curate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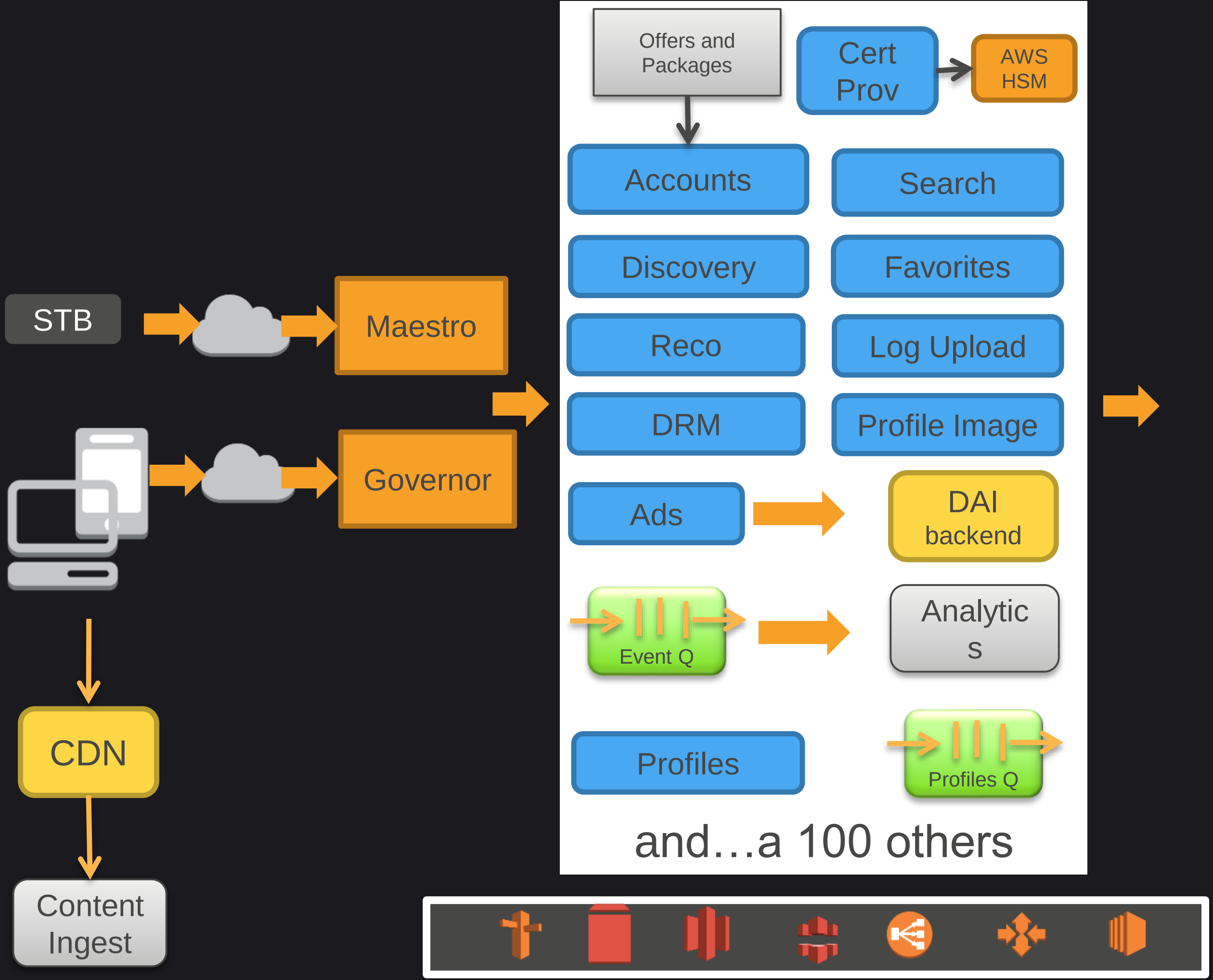
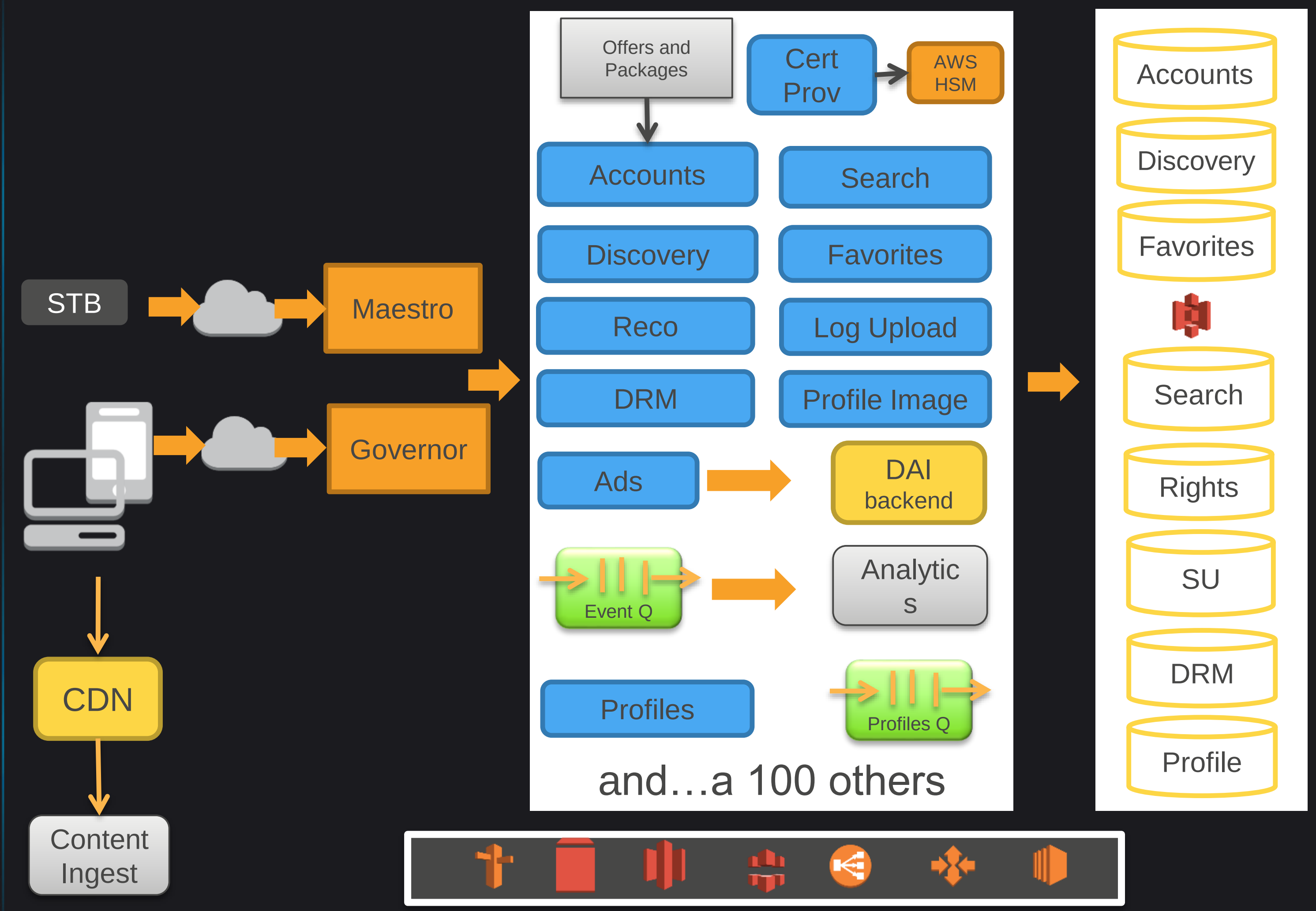
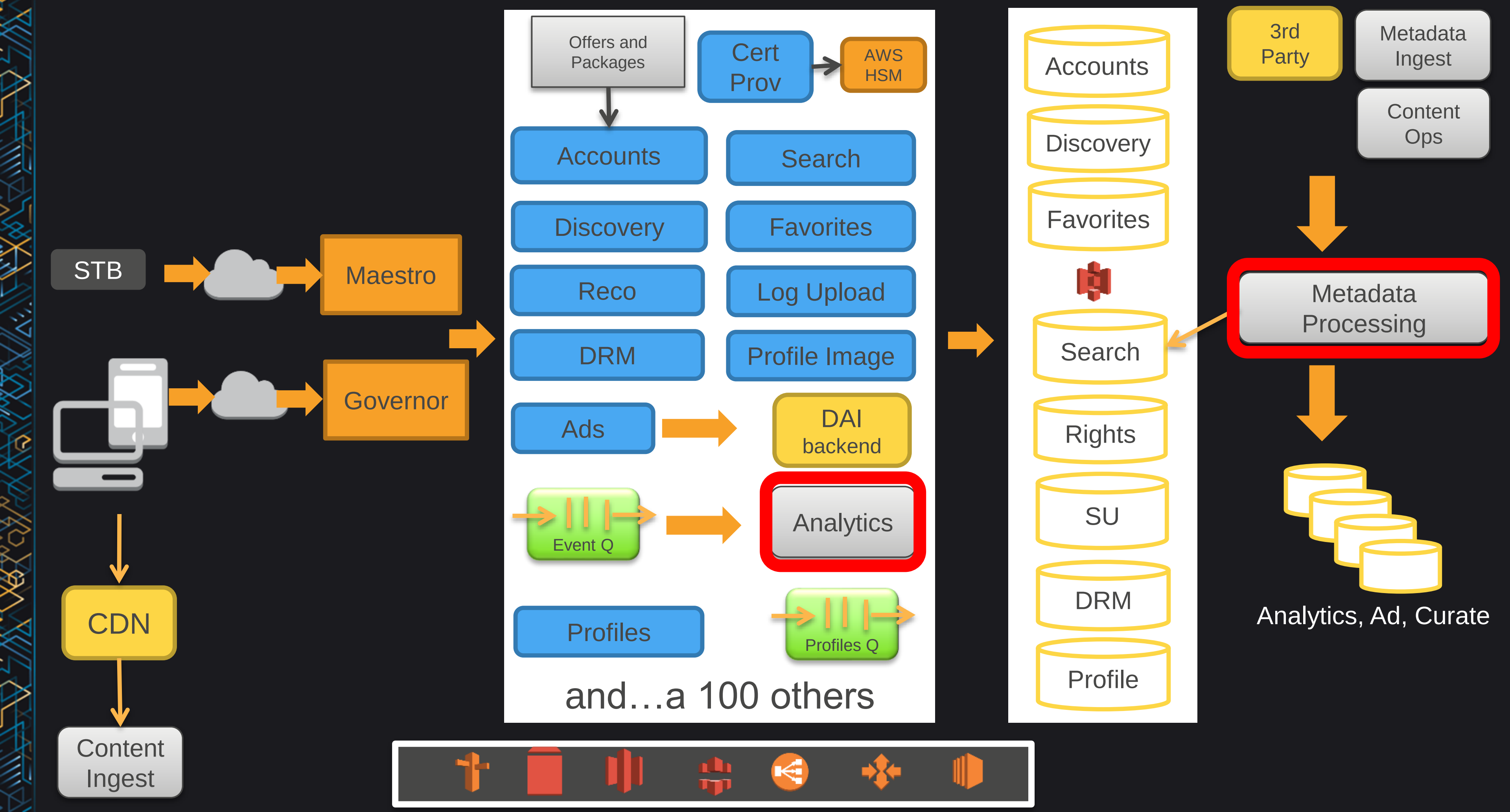

Offers and Packages
Cert Prov
AWS HSM
Accounts
Search
Discovery
Favorites
STB
Maestro
Reco
Log Upload
DRM
Profile Image
Governor
Ads
DAI backend
Event Q
Analytic s
CDN
Profiles
Profiles Q
and…a 100 others
Content Ingest


STB
Maestro
Governor
CDN
Content Ingest
Offers and Packages
Cert Prov
AWS HSM
Accounts
Search
Discovery
Favorites
Reco
Log Upload
DRM
Profile Image
Ads
DAI backend
Event Q
Analytic s
Profiles
Profiles Q
and…a 100 others
Accounts
Discovery
Favorites
Search
Rights
SU
DRM
Profile


STB
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and…a 100 others
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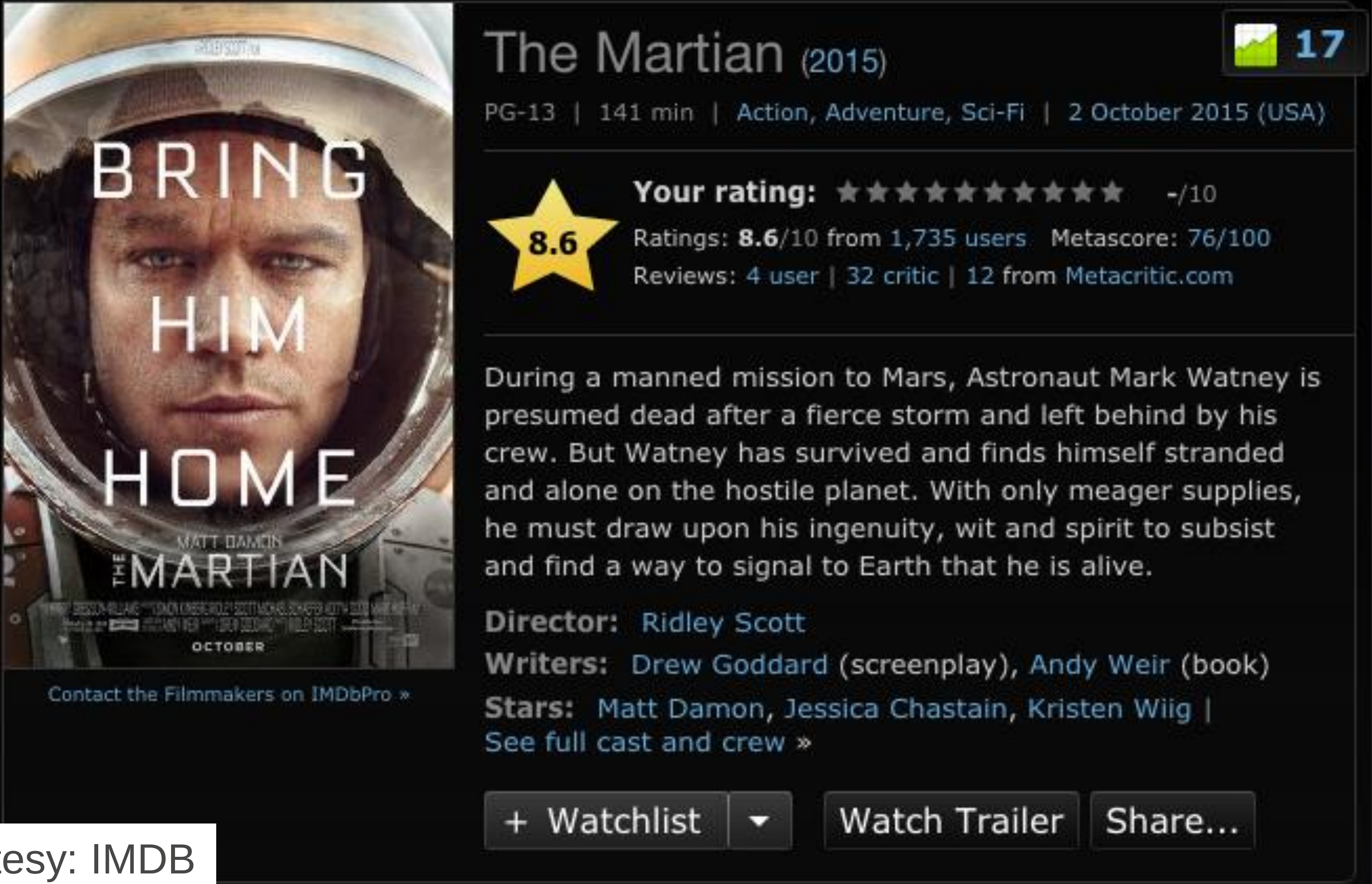
Favorites
Search
Rights
SU
DRM
Profile
3rd Party
Metadata Ingest
Content Ops
Metadata Processing
Analytics, Ad, Curate

Metadata — Ingest and Storage



The Martian (2015)

17

PG-13 | 141 min | Action, Adventure, Sci-Fi | 2 October 2015 (USA)

8.6

Your rating: ★★★★★★★★★★ -/10

Ratings: **8.6**/10 from 1,735 users Metascore: 76/100

Reviews: 4 user | 32 critic | 12 from Metacritic.com

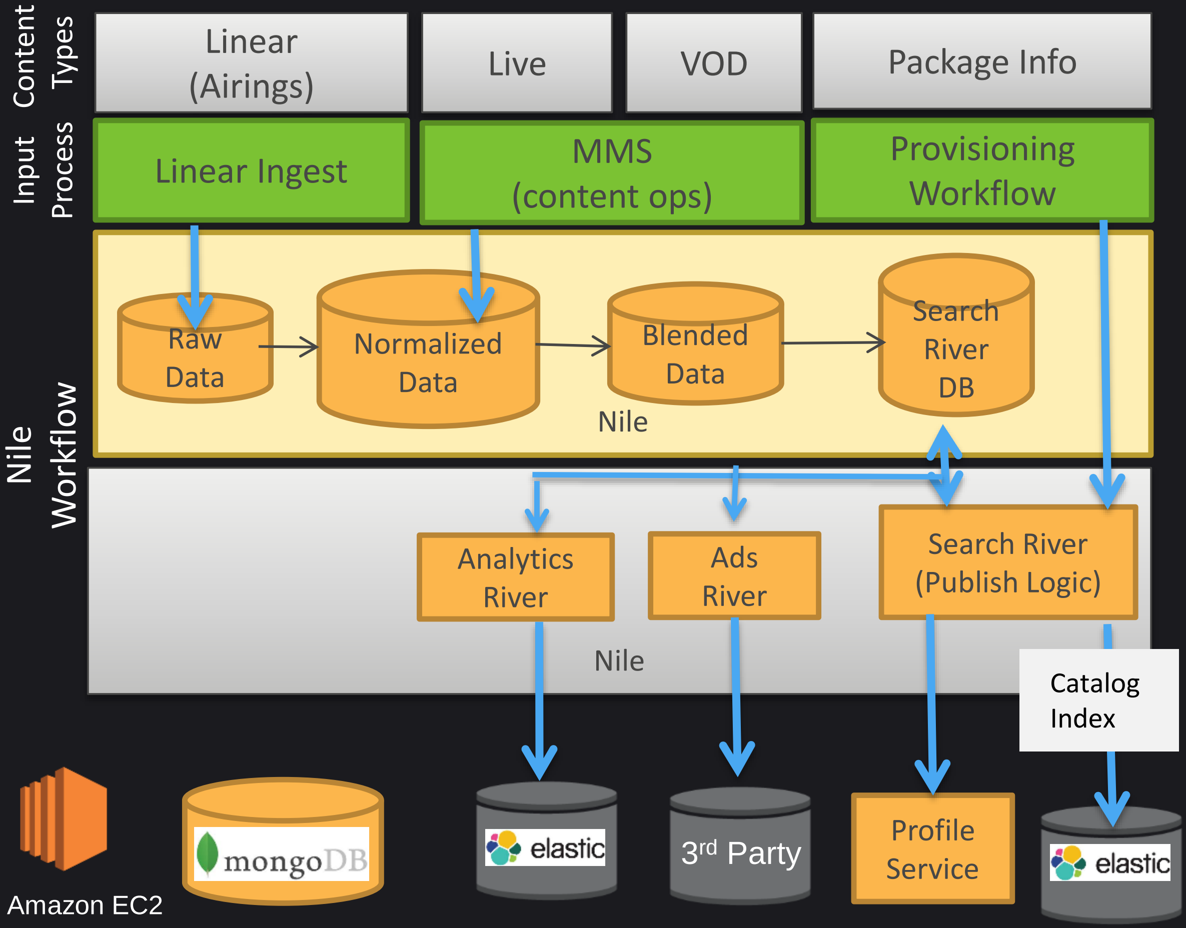
During a manned mission to Mars, Astronaut Mark Watney is presumed dead after a fierce storm and left behind by his crew. But Watney has survived and finds himself stranded and alone on the hostile planet. With only meager supplies, he must draw upon his ingenuity, wit and spirit to subsist and find a way to signal to Earth that he is alive.

Director: Ridley Scott

Writers: Drew Goddard (screenplay), Andy Weir (book)

Stars: Matt Damon, Jessica Chastain, Kristen Wiig |
See full cast and crew »

Courtesy: IMDB


Content Types
Linear (Airings)
Live
VOD
Package Info
Input Process
Linear Ingest
MMS (content ops)
Provisioning Workflow
Nile Workflow
Raw Data
Normalized Data
Blended Data
Search River DB
Nile
Analytics River
Ads River
Search River (Publish Logic)
Nile
Catalog Index
Amazon EC2
mongoDB
elastic
3rd Party
Profile Service
elastic

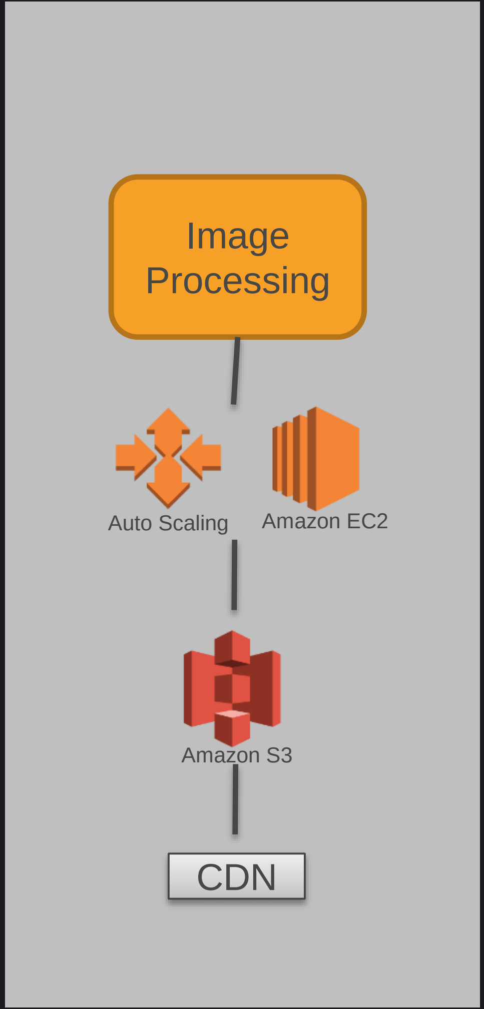



Image Processing
Auto Scaling
Amazon EC2
Amazon S3
CDN

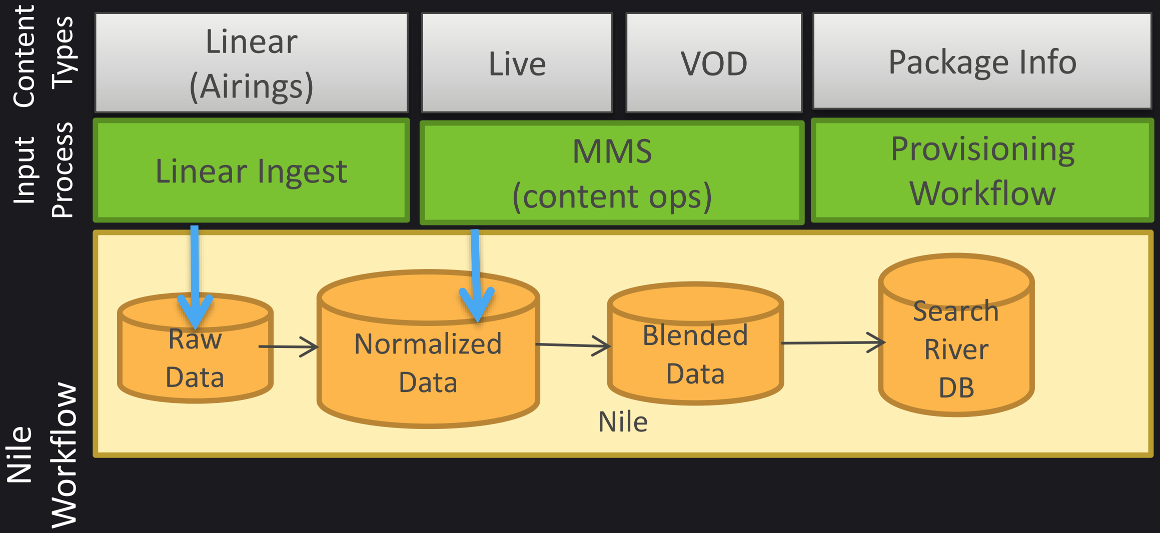
Content Types

Linear (Airings) | Live | VOD | Package Info

Amazon EC2

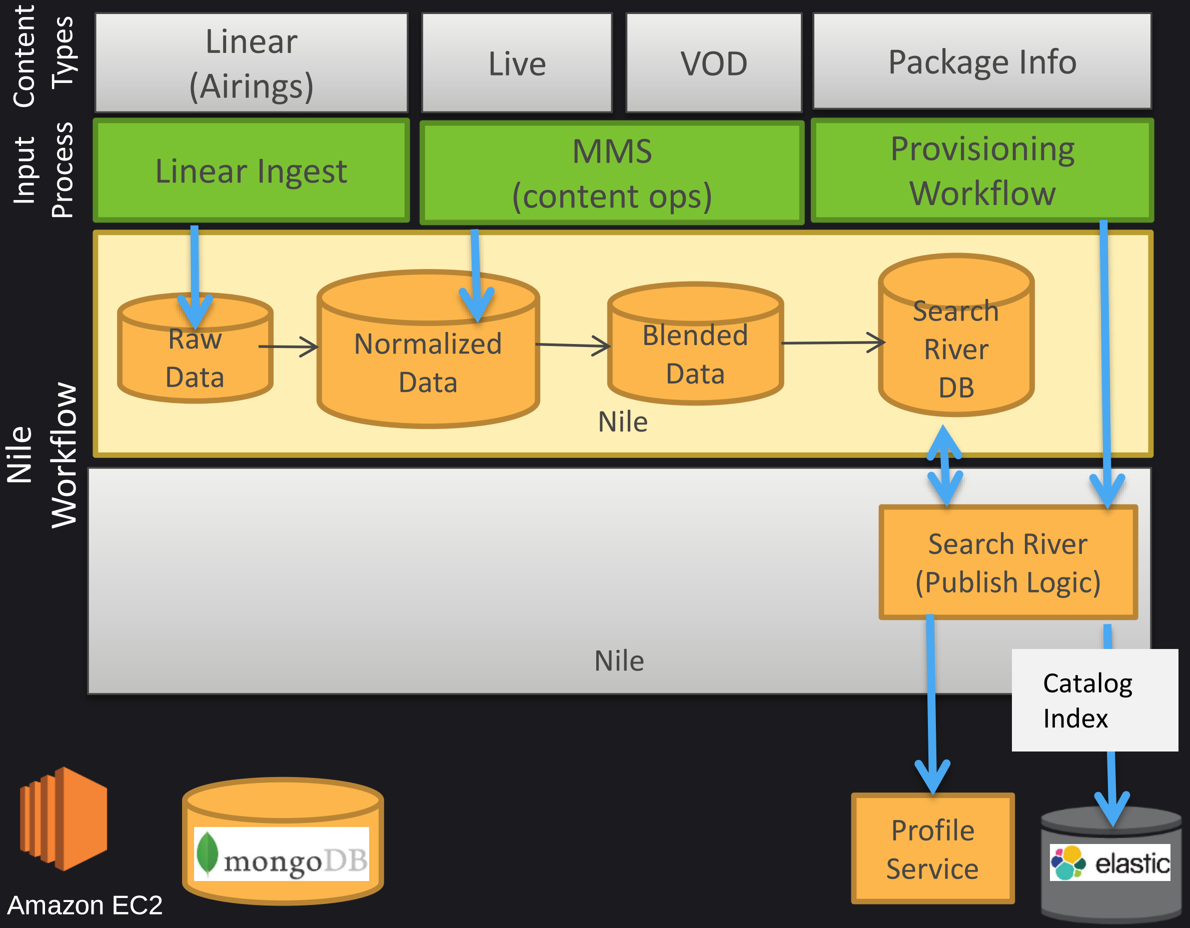
Content Types	Linear (Airings)	Live	VOD	Package Info
Input Process	Linear Ingest	MMS (content ops)		Provisioning Workflow

Amazon EC2



Content Types
Linear (Airings)
Live
VOD
Package Info
Input Process
Linear Ingest
MMS (content ops)
Provisioning Workflow
Nile Workflow
Raw Data
Normalized Data
Blended Data
Search River DB
Nile

Amazon EC2
mongoDB


Content Types
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Package Info
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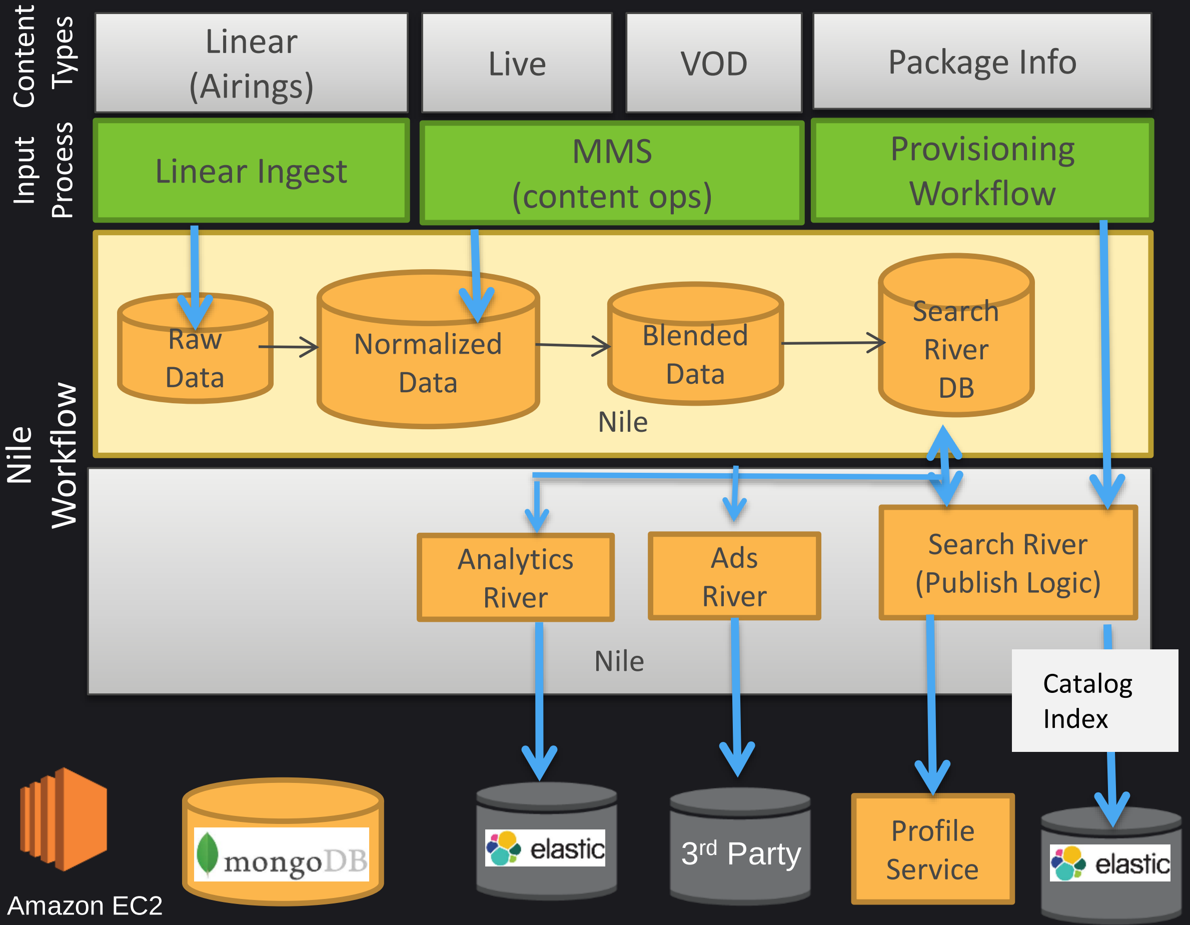
MMS (content ops)
Provisioning Workflow
Nile Workflow
Raw Data
Normalized Data
Blended Data
Search River DB
Nile
Search River (Publish Logic)
Nile
Catalog Index
Profile Service
elastic
Amazon EC2
mongoDB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Profile Service
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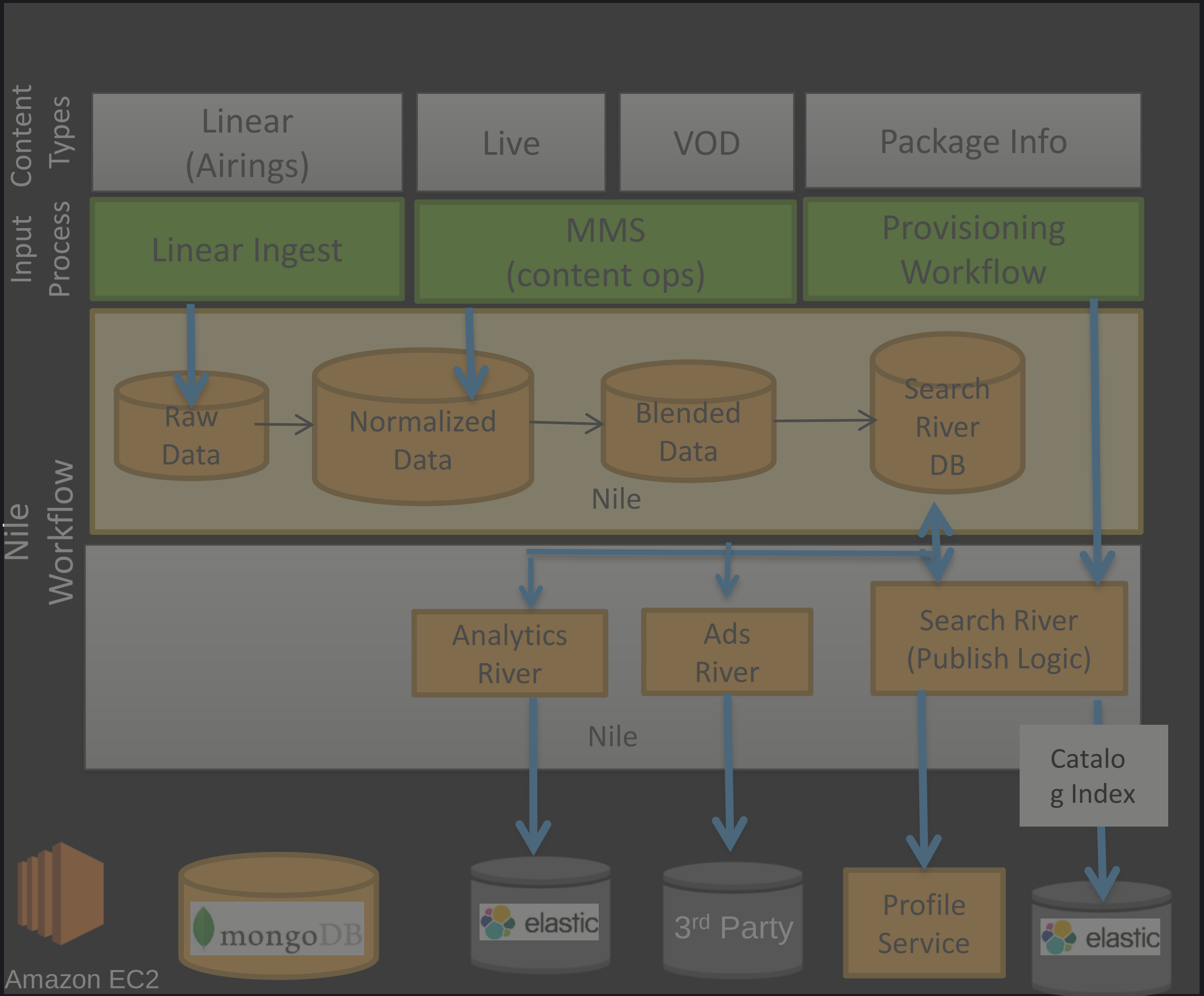
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Input Process
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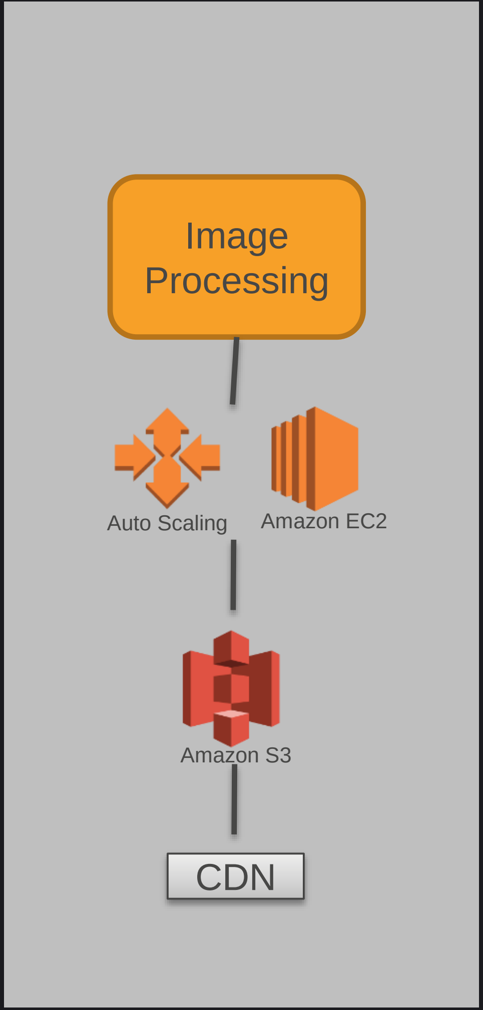
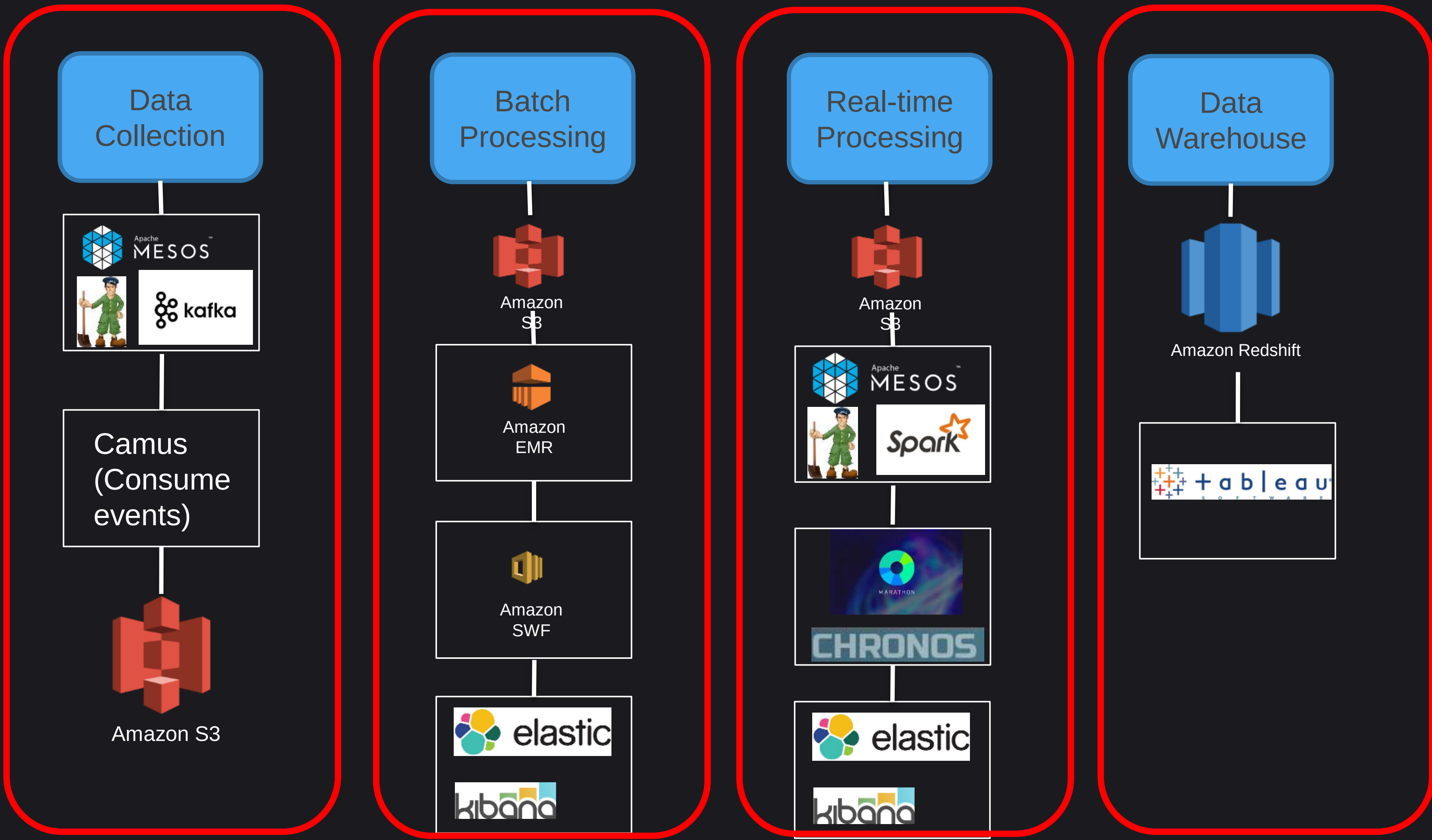


Image Processing
Auto Scaling
Amazon EC2
Amazon S3
CDN

Product Intelligence


Data Collection
Apache MESOS
kafka
Camus (Consume events)
Amazon S3
Batch Processing
Amazon S3
Amazon EMR
Amazon SWF
elastic
kibana
Real-time Processing
Amazon S3
Apache MESOS
Spark
MARATHON
CHRONOS
elastic
kibana
Data Warehouse
Amazon Redshift
tableau software

Best Practices

Avoid a priori optimization

Deploy often

Keep simple and separate systems

Don’t always give in to “right tool for the right job”

Summary

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- Deploy often
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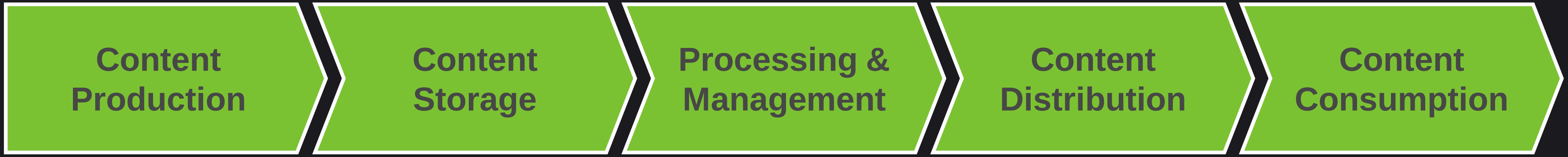

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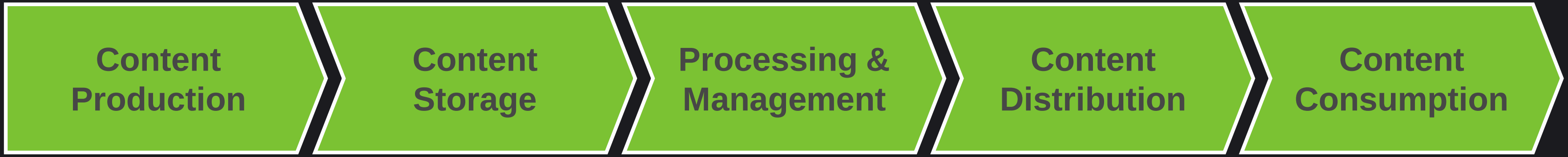

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Go Build.

Thank you!

Remember to complete your evaluations!