The Evolving Media Pipelines aided by Machine Learning

Usman Shakeel | WW Tech Leader M&E @ AWS
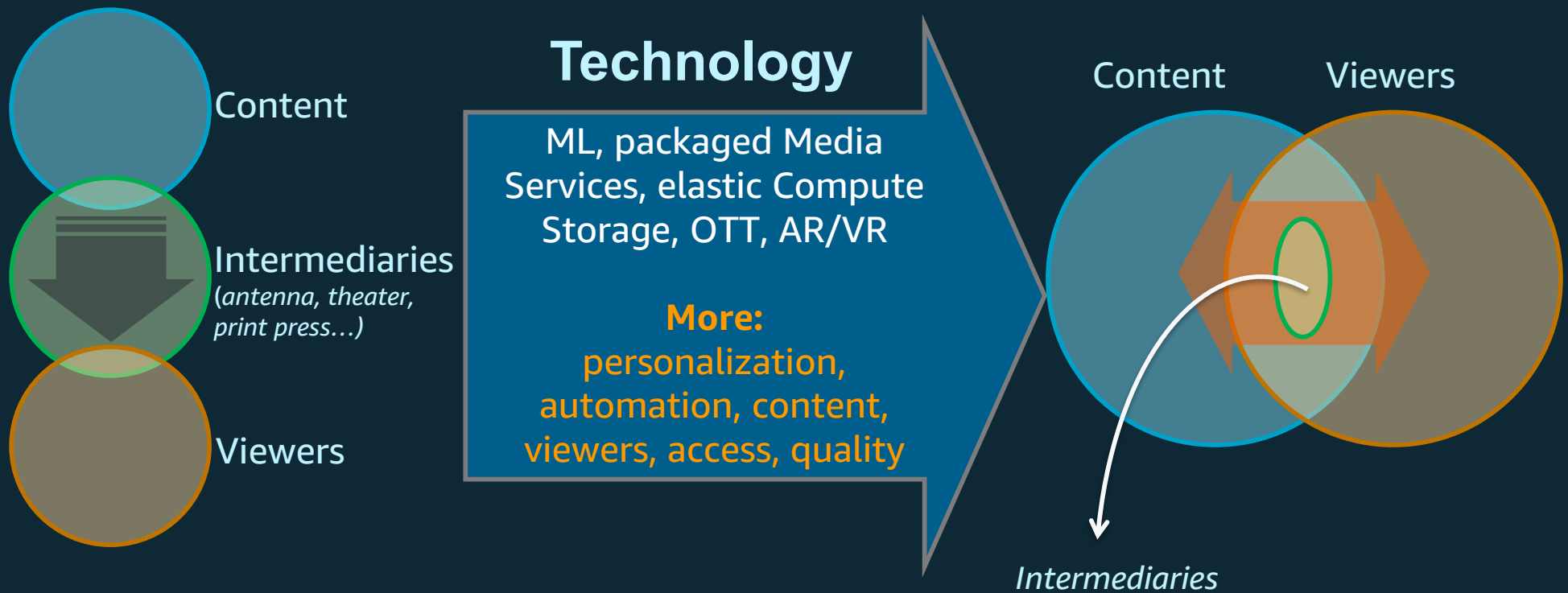
Current State of Media Business

From creation to consumption, the what/how/where/when/who is making and watching content is changing faster than ever

aws

The Media & Entertainment 'Singularity'

Content

Intermediaries
(*antenna, theater, print press…*)

Viewers

Technology

ML, packaged Media Services, elastic Compute Storage, OTT, AR/VR

More:
personalization, automation, content, viewers, access, quality

Content   Viewers

Intermediaries

aws

The Media & Entertainment Singularity

Content Depth
Content Anywhere, Anytime
Personalization

aws

ML-aided Evolving Media Pipelines

Content Depth = Create and Curate Content (ML aided)
Anywhere, Anytime = Scale the Supply Chain (ML aided)
Personalization = Make Sense of a lot of Data (ML aided)

aws

A quick segue: ML toolchain within AWS

Our vision: *"Put machine learning in the hands of every developer and data scientist"*

aws

Solutions for Every Skill Level

Services
- Designed for Developers & Data Scientists
- Solution-oriented Prebuilt Models Available via APIs
- Image Analysis, NLU, NLP, Translation, Text-to-Speech & Speech-to-Text

Platforms
- Designed for Data Scientists to Address Common & Advanced ML Needs
- Fully Managed Platform for Model Building
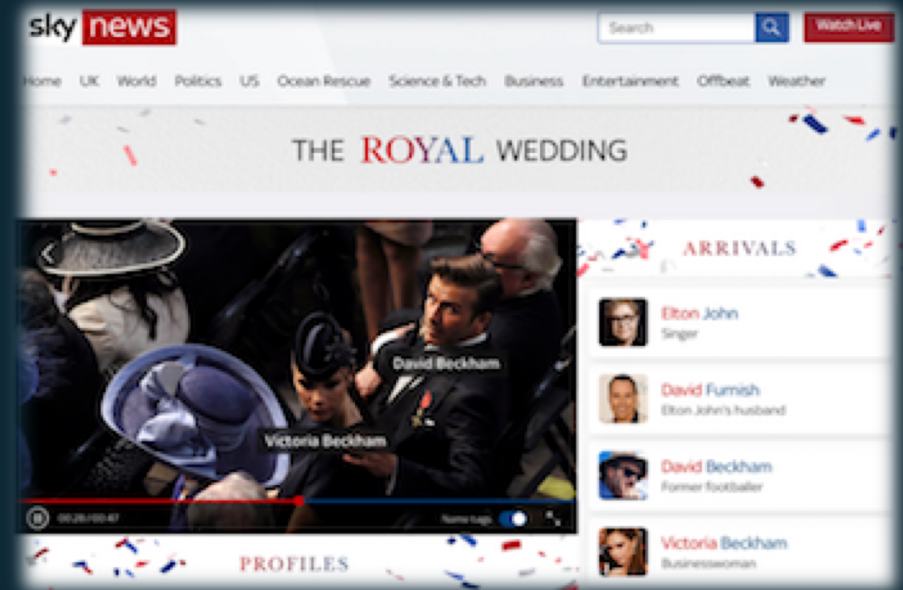- Reduces the Heavy Lifting in Model Building & Deployment

Frameworks
- Designed for Data Scientists to Address Advanced / Emerging Needs
- Provides Maximum Flexibility to develop on the leading AI Frameworks
- Enables Expert AI Systems to be Developed & Deployed

aws

AWS ML in Use

NFL teams with AWS on statistics package driven by machine learning

*Sky News and AWS Bring ML Mainstream for **Live Video with Royal Wedding: Who's Who***
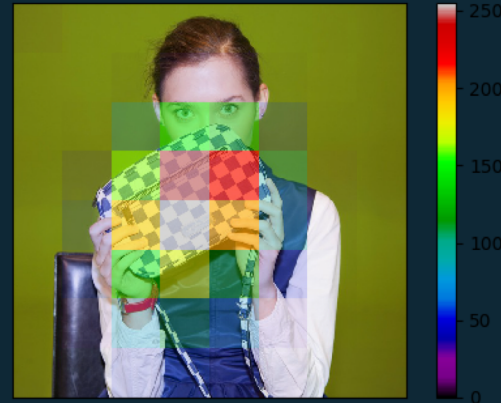*- May 2, 2018*

aws

AWS ML in Use

C-SPAN

Over 99,000 faces indexed and searchable from over 200,000 hrs of content in

CONDÉ NAST

Condenast uses image analysis for recommending the right content based on user views

aws

Machine Learning On AWS

APPLICATION SERVICES

| Rekognition | Transcribe | Translate | Polly | Comprehend | Lex |

PLATFORM SERVICES

| Amazon SageMaker | AWS DeepLens |

FRAMEWORKS & INTERFACES

AWS Deep Learning AMIs

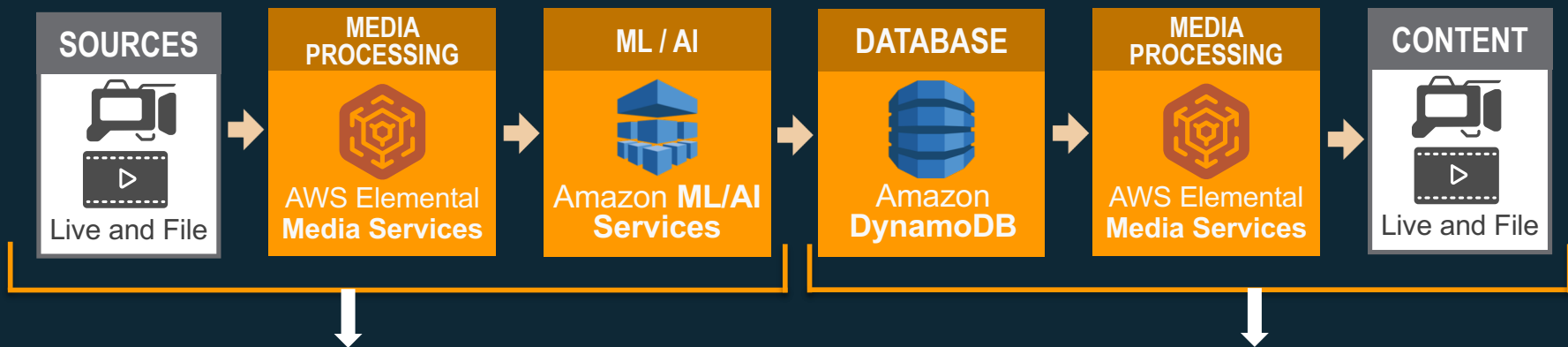| Caffe2 | CNTK | Apache MXNet | PyTorch | TensorFlow | Torch | Keras | Gluon |

INFRASTRUCTURE

| GPU (P3) | CPU | IoT & Edge | Mobile |

aws

Using Amazon AI/ML Services for Media

SOURCES	MEDIA PROCESSING	ML / AI	DATABASE	MEDIA PROCESSING	CONTENT
Live and File	AWS Elemental **Media Services**	Amazon **ML/AI Services**	Amazon **DynamoDB**	AWS Elemental **Media Services**	Live and File

Content Indexing / Metadata Generation

- Use services such as Amazon Rekognition & Amazon Transcribe to generate metadata about your content
- Store that metadata and making it searchable

Content Retrieval / Action Metadata

- Database tells you scene exists in a given file at a given time
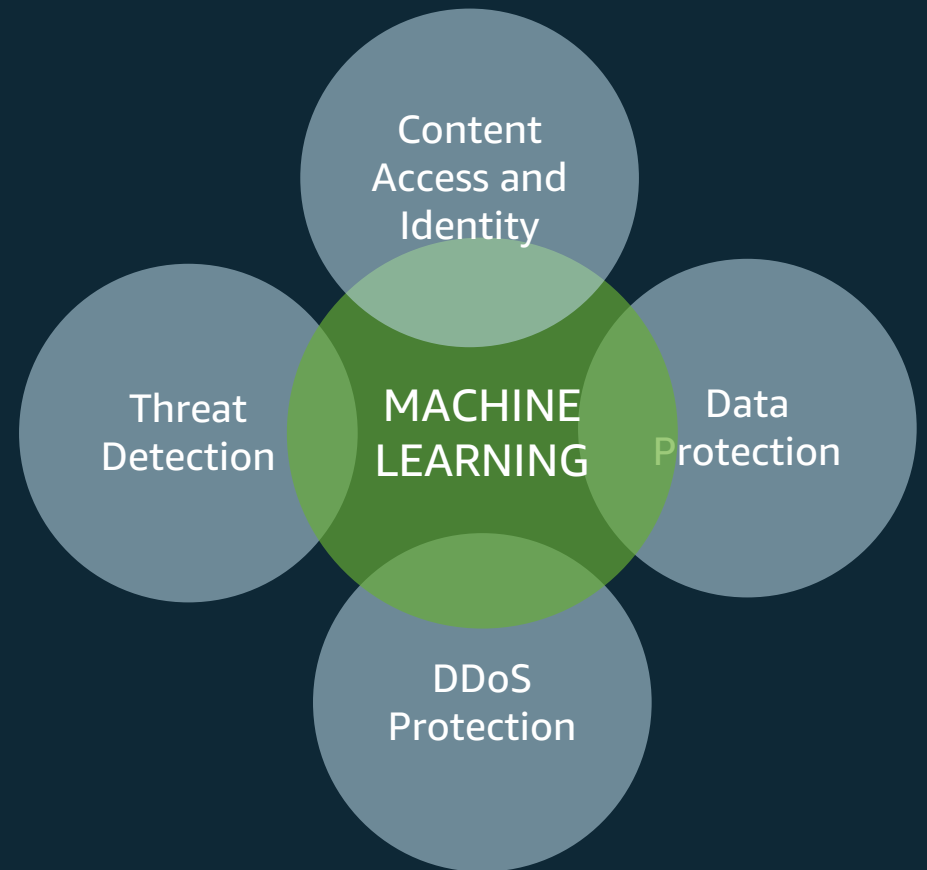- Retrieve it for timely use

aws

AWS Managed Security with ML Built In

amazon
Macie
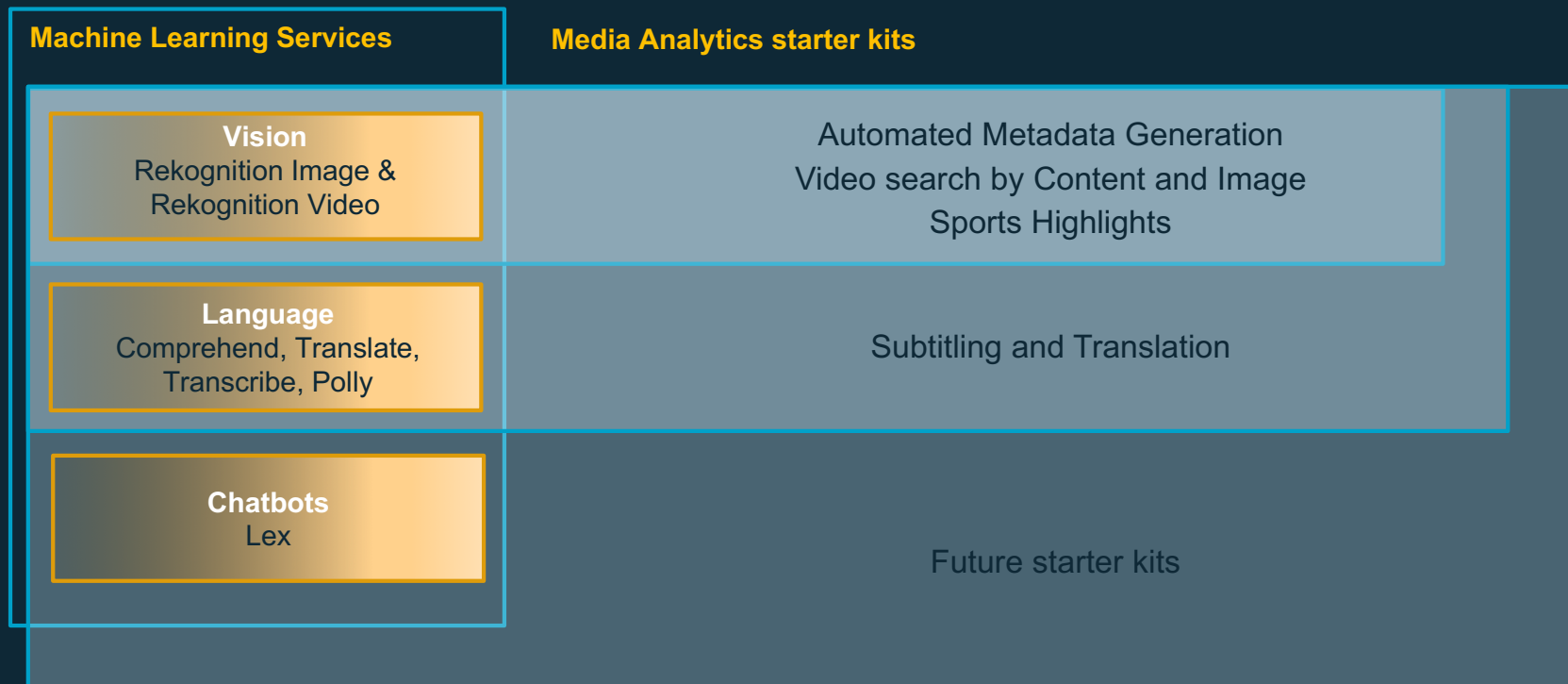
AWS Shield
Advanced

Amazon
GuardDuty

Content Access and Identity

Threat Detection

MACHINE LEARNING

Data Protection

DDoS Protection

aws

Media Analytics starter kits

Automatically provision the services necessary for building common media use cases on AWS

Machine Learning Services

Media Analytics starter kits

Vision
Rekognition Image &
Rekognition Video

Automated Metadata Generation
Video search by Content and Image
Sports Highlights

Language
Comprehend, Translate,
Transcribe, Polly

Subtitling and Translation

Chatbots
Lex

Future starter kits

aws.amazon.com > answers > media-entertainment

aws

Challenges with Deep Learning
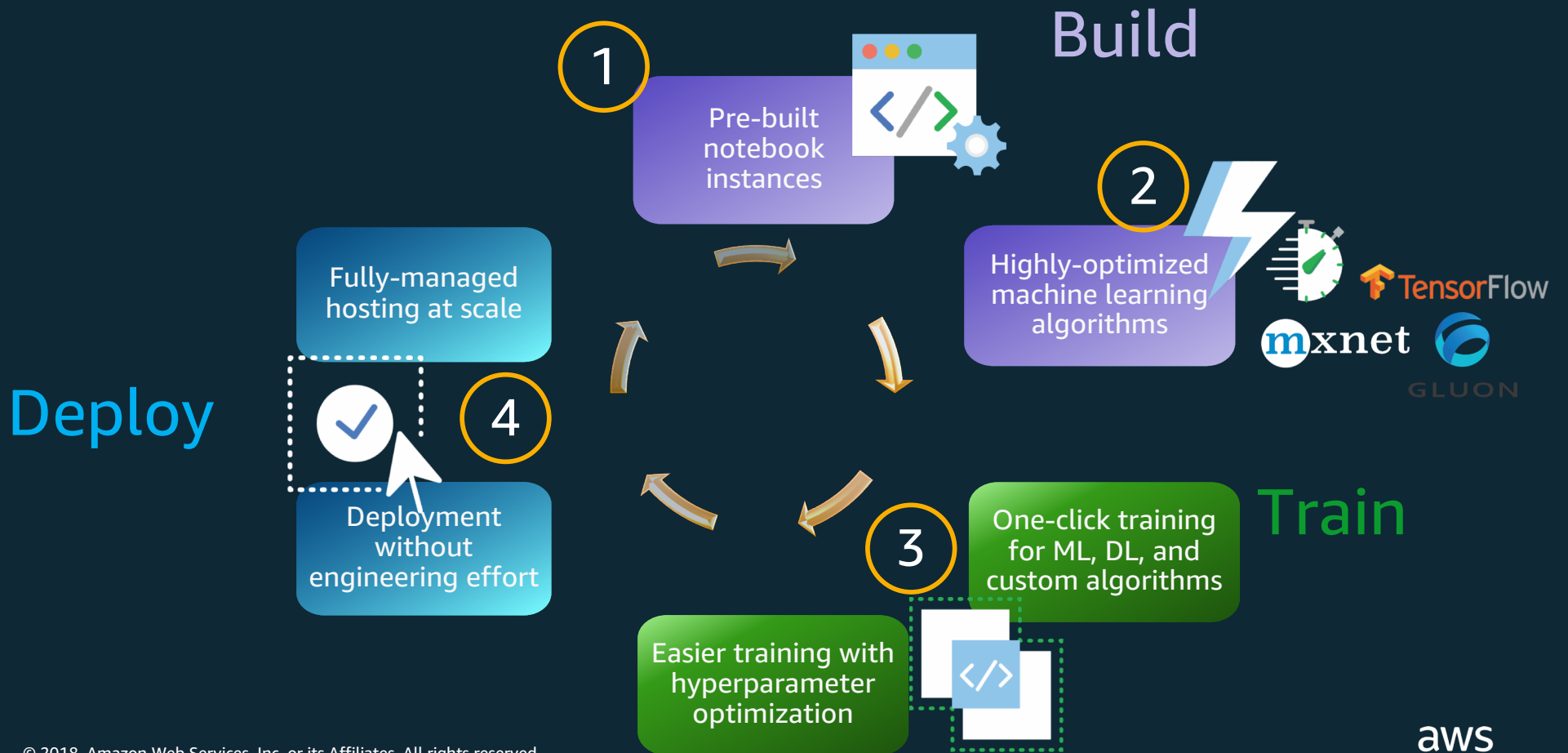
Scalability **Flexibility**

Training

Flexibility in ML

Every business case requires custom ML

- Dataset
- Training Model, Algorithms and variable sets
- Scale
- Use Case Requirements (consumption patterns)

aws

Amazon SageMaker

Build

1 — Pre-built notebook instances

2 — Highly-optimized machine learning algorithms

TensorFlow
mxnet
GLUON

Train

3 — One-click training for ML, DL, and custom algorithms

Easier training with hyperparameter optimization

Deploy

Fully-managed hosting at scale

4 — Deployment without engineering effort

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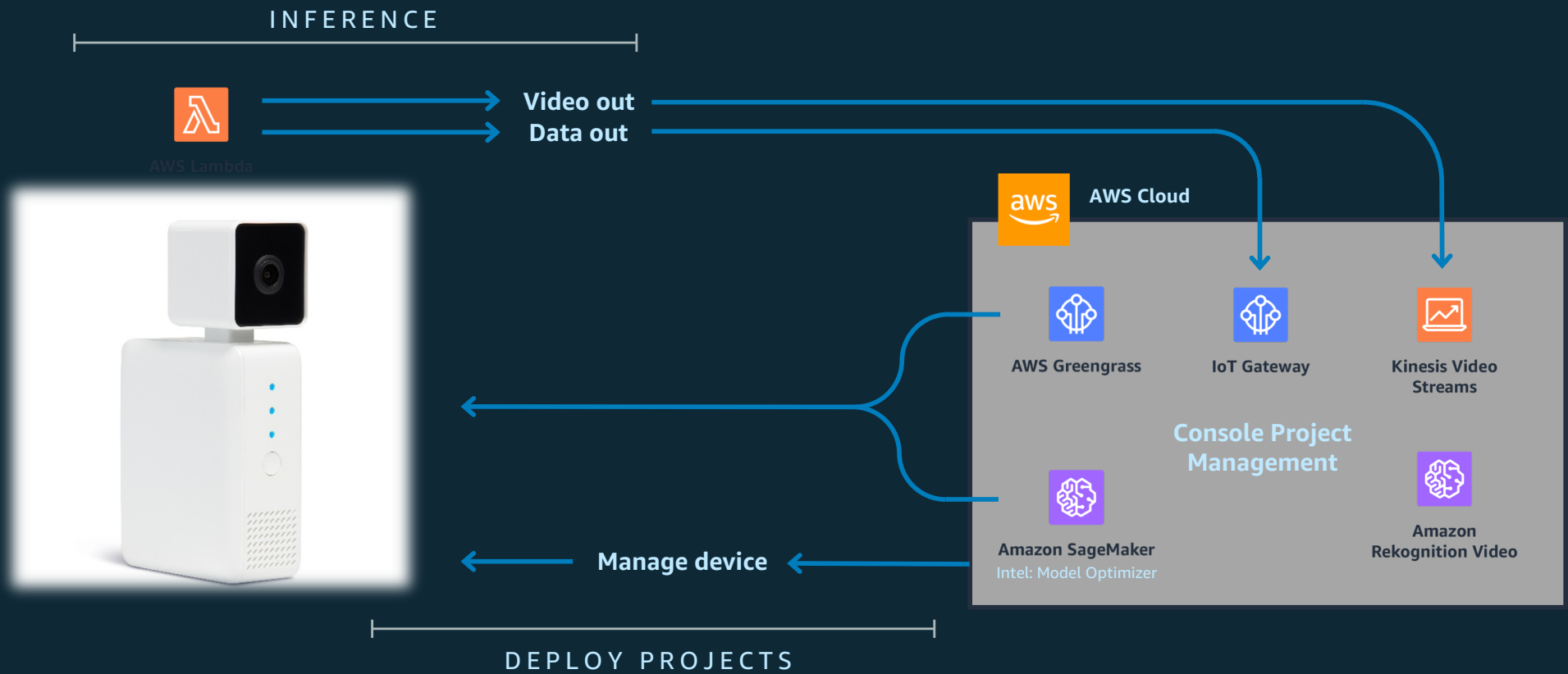
aws

AWS DeepLens: A Deep Learning-Enabled Video Camera for Developers (June 2018)

- Fully programmable video camera

- Optimized for deep-learning on the device with Apache MXNet, Caffe, TensorFlow

- Tutorials, sample code, examples, and pre-built models

- Integrated with Amazon Sagemaker for custom models

aws

AWS Deep Lens Architecture

INFERENCE

AWS Lambda

Video out
Data out

aws AWS Cloud

AWS Greengrass

IoT Gateway

Kinesis Video
Streams

Console Project
Management

Amazon SageMaker
Intel: Model Optimizer

Amazon
Rekognition Video

Manage device

DEPLOY PROJECTS

aws

ML-aided Evolving Media Pipelines

Content Depth = Create and Curate Content (ML aided)
Anywhere, Anytime = Scale the Supply Chain (ML aided)
Personalization = Make Sense of a lot of Data (ML aided)

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Content Depth = Create and Curate Content

Color Correction Workflow

QC Workflow

Scene Extraction

Highlights Creation, Automated Editing, Split Checks/False Takes

Performance Optimization

Caption Generation/Translations
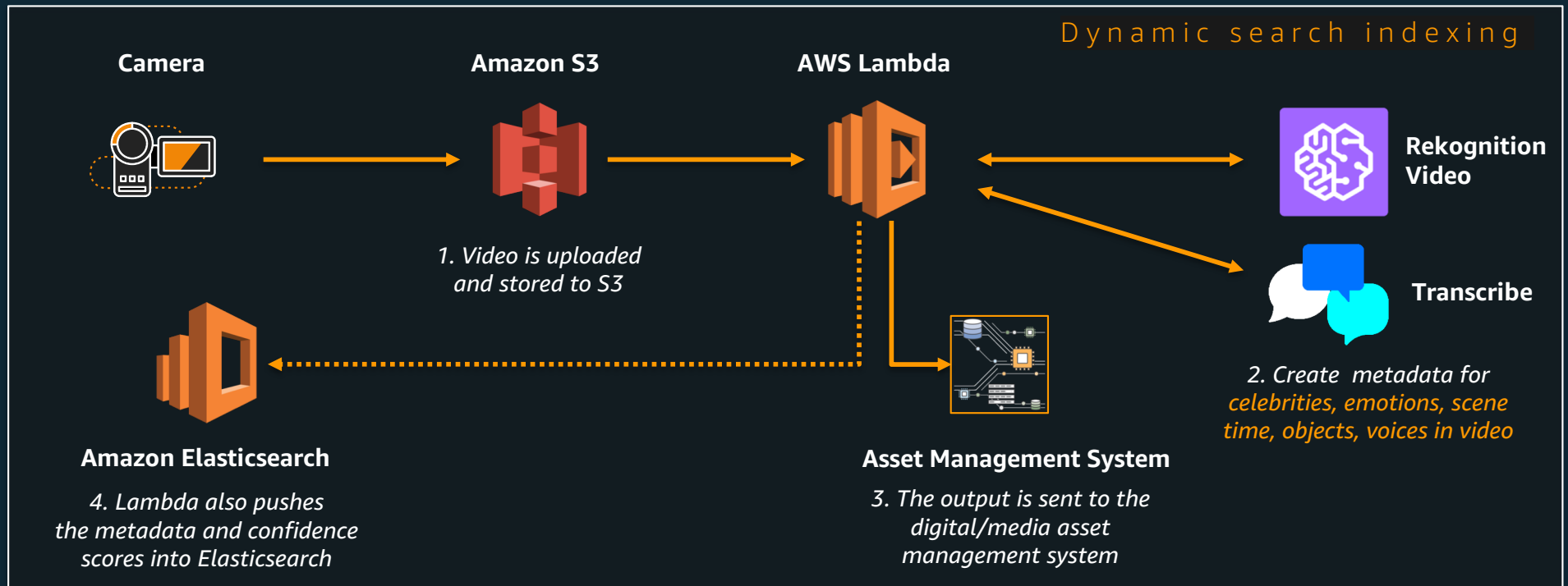
Automated Narration Generation

Roto/Depth Detection/3D Conversions

Real-time Lip Sync of CG models

ML aided VFX bidding

aws

Automated Media Metadata Tagging

Use case : Video Search Index

Dynamic search indexing

Camera

Amazon S3

AWS Lambda

Rekognition Video

1. Video is uploaded and stored to S3

Transcribe

2. Create metadata for celebrities, emotions, scene time, objects, voices in video

Amazon Elasticsearch

4. Lambda also pushes the metadata and confidence scores into Elasticsearch

Asset Management System

3. The output is sent to the digital/media asset management system

aws

Person in Scene Detection

Recognition and tracking of on-screen persons

Amazon S3

1. Store images of recognized people

Rekognition

2. Index individuals into a collection

Face collection
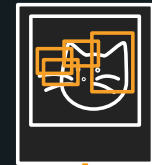
Videos

Amazon S3

3. Store video files

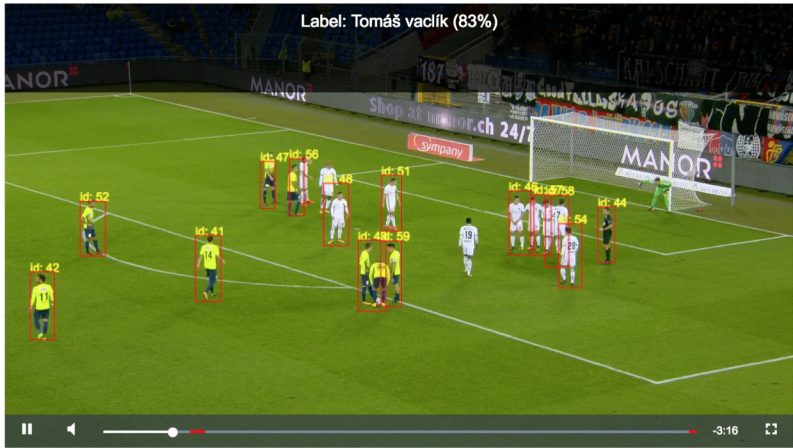**AWS Lambda**

5. Summarize time on screen detail

Rekognition Video

Transcribe

4. Track persons on screen and recognize individual faces and voices

aws

Label: Tomáš vaclík (83%)

-3:16

◀◀ PREV   ▶▶ NEXT

👤 Track People: ☑

| Player Stats | Labels |

Tomáš Vaclík

Position: Goalkeeper

Team: FC Basel 1893

Appears in this video: 17 time(s)

| People | Faces |

People who features this video

Marek Suchý

Appears in this video: 4 time(s)

Luca Zuffi

Appears in this video: 14 time(s)
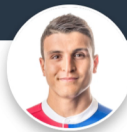

Tomáš Vaclík

Appears in this video: 17 time(s)

Albian Ajeti

Appears in this video: 2 time(s)

Mohamed Elyounoussi

Appears in this video: 3 time(s)

Raoul Petretta

Appears in this video: 6 time(s)

Microsoft Word

aws

ML Aided Content Curation

Metadata Capture

Disaggregated Sources of metadata: *Different aspects of the* **workflow** *across different* **organizations** *across different* **systems** *and* **physical locations**

Metadata Extraction

- Object Tagging
- Person in Scene Detection and follow the person in the video
- Text Extraction
- Speech to Text
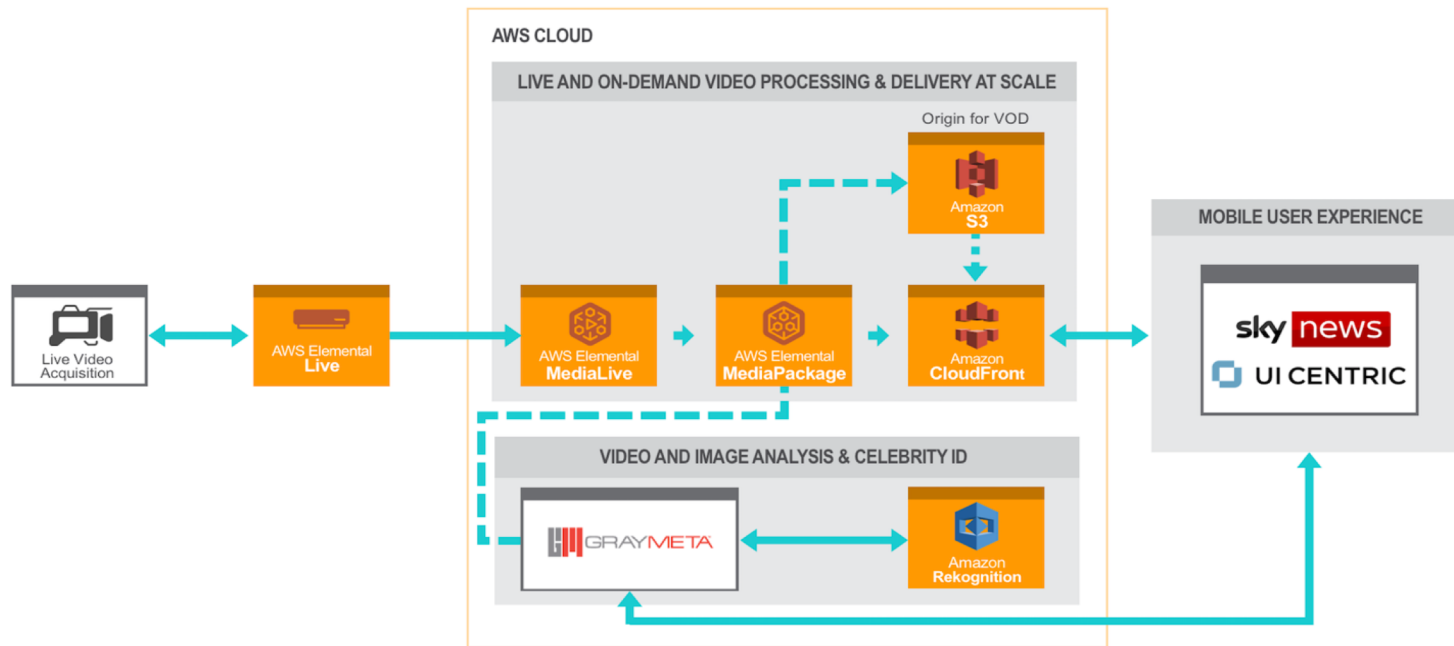
aws

The Royal Wedding – Behind the Scenes

Anywhere, Anytime = Scale the Supply Chain
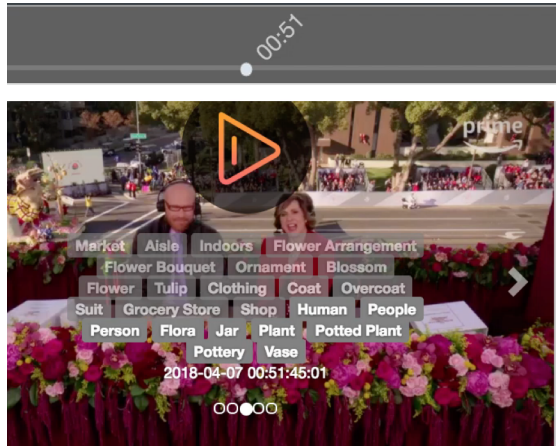
QC Workflow

Conformance/Compliance

Performance Optimization

Caption Generation/Translations

Automated Narration Generation

Person/Celebrity/Player Tagging/Tracking

aws

00:51   00:50   00:49

Panel 1:

prime

Market | Aisle | Indoors | Flower Arrangement
Flower Bouquet | Ornament | Blossom
Flower | Tulip | Clothing | Coat | Overcoat
Suit | Grocery Store | Shop | Human | People
Person | Flora | Jar | Plant | Potted Plant
Pottery | Vase

2018-04-07 00:51:45:01

from *2018-04-07T00:51:03+00:00 to 2018-04-07T00:52:03+00:00*

Amazon Transcribe and Amazon Translate 9

Amazon Comprehend 2
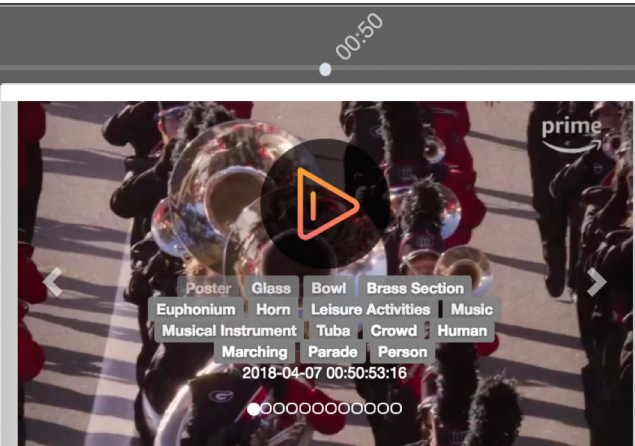
Overall Sentiment

Mixed | Positive | Neutral | Negative

Key Phrases | Person 4

...ck it off your, you know, get rid of him with slowing. I just worry about ...elings you have do it through **email** sent. It'll only i'll text if you're afraid ...n **person** said, this is **fun** fired through **evening** send, send, you're ...u're fired. Who did that ? Was **that part** of **a george carlin routine** ...ll, if i, **uh** yeah, i don't know what i'd always garland. It might be george ...no, like i did to he now he was on **sarah** . I live with **timmy meadows** , i ...now. Next we have up **the rotary** rose **parade committee** presents ...p **the seeds** of **service** at **a glance** . **The whimsical bunny** , gazing ...just planted **peachtree** appears to be having **a fun day** . However, if ...k beyond **the flowers** beyond , **the plant material** , what you will find is

Rekognition 3

Panel 2:

prime

Poster | Glass | Bowl | Brass Section
Euphonium | Horn | Leisure Activities | Music
Musical Instrument | Tuba | Crowd | Human
Marching | Parade | Person

2018-04-07 00:50:53:16

from *2018-04-07T00:50:03+00:00 to 2018-04-07T00:51:03+00:00*

Amazon Transcribe and Amazon Translate 9

Amazon Comprehend 2

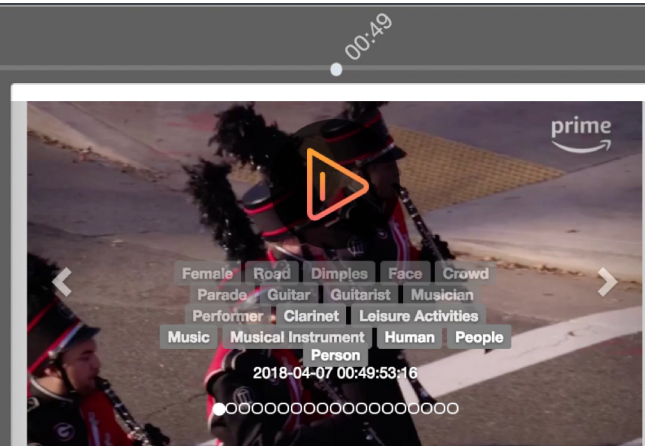Overall Sentiment

Mixed | Positive | Neutral | Negative

Key Phrases | Location 1

This is not since **nonsense** written by **our reserve** to happen to go to **the university** of **georgia** . I'll tell you what, **tish** let's, just listen to **this wonderful red coat** , **marching band** , play way. We're just going to fire **the reason** that i don't know. I don't know something just right **that way** , **no one** will be **associate** with **schools** playing in **the room** , you know, they need to have **an unbiased opinion** that can't be even even handed. I'll fire and for me to watch, i can fire him. I like **firing people** . I actually get off, okay, enjoy it, i'll do it, you can do it with me. **All right** , well, if you want it, i get uncomfortable in **a confrontation** like i don't like it, get rid of him sooner rather than later, so i really enjoy what it's like to get it done, okay ?

Rekognition 3

Panel 3:

prime

Female | Road | Dimples | Face | Crowd
Parade | Guitar | Guitarist | Musician
Performer | Clarinet | Leisure Activities
Music | Musical Instrument | Human | People
Person

2018-04-07 00:49:53:16

from *2018-04-07T00:49:03+00:00 to 2018-04-07T00:50:03+00:00*

Amazon Transcribe and Amazon Translate 9

Amazon Comprehend 3

Overall Sentiment

Mixed | Positive | Neutral | Negative

Key Phrases | Quantity 2 | Location 7

It is **the big winner** and gets **first prize** as **the best float** of **the day** . But remember, **our researcher** , **danny** is from **the university** of **georgia** and i think he's showing **a little unfair bias** . **What else** did he write down about this for ? Well, i'll keep reading what he wrote, he said. **This road** is so much cooler than **the float** from **the university** of **oklahoma** could probably beat out **the oklahoma** in **a fight** . Maybe we shouldn't have fired **a researcher** , which of **the university** of **ways** writing **another marching band** . Here comes **the university** of **georgia red code** marching **band span** has sold **more records** than **the beatles** and **his hands** down **the greatest marching band** of **any kind** and **the war ok** , **wait** , i can't read any of this it's **all one** sided. Oh it's had, because this really in

Rekognition 3

Logo Detection with Amazon SageMaker

Prepare   **Train & Optimize**   **Deploy**

SageMaker
Notebooks

Raw
Data

Prepared Data
Caltech Images

Amazon S3

Training Data

Training
Algorithm
Image Classification

HPO

SageMaker
Training

Trained
Model

Algorithm
Container

Trained
Model

Amazon S3

SageMaker
Hosting

Inference requests

User
Interactions

AWS
Lambda

API
Gateway

aws
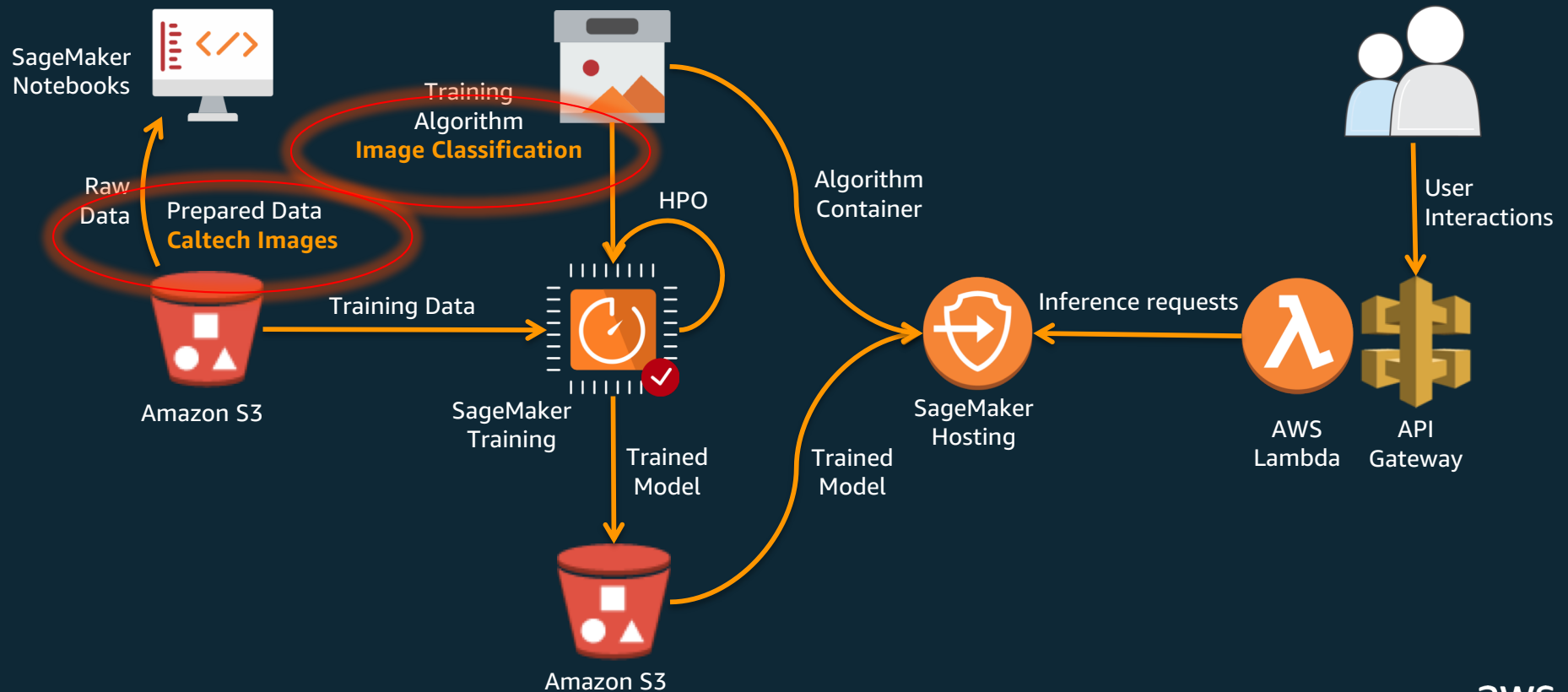
Logo Detection Demo with Amazon SageMaker

aws

ML Aided Content Monetization Flywheel

Inputs

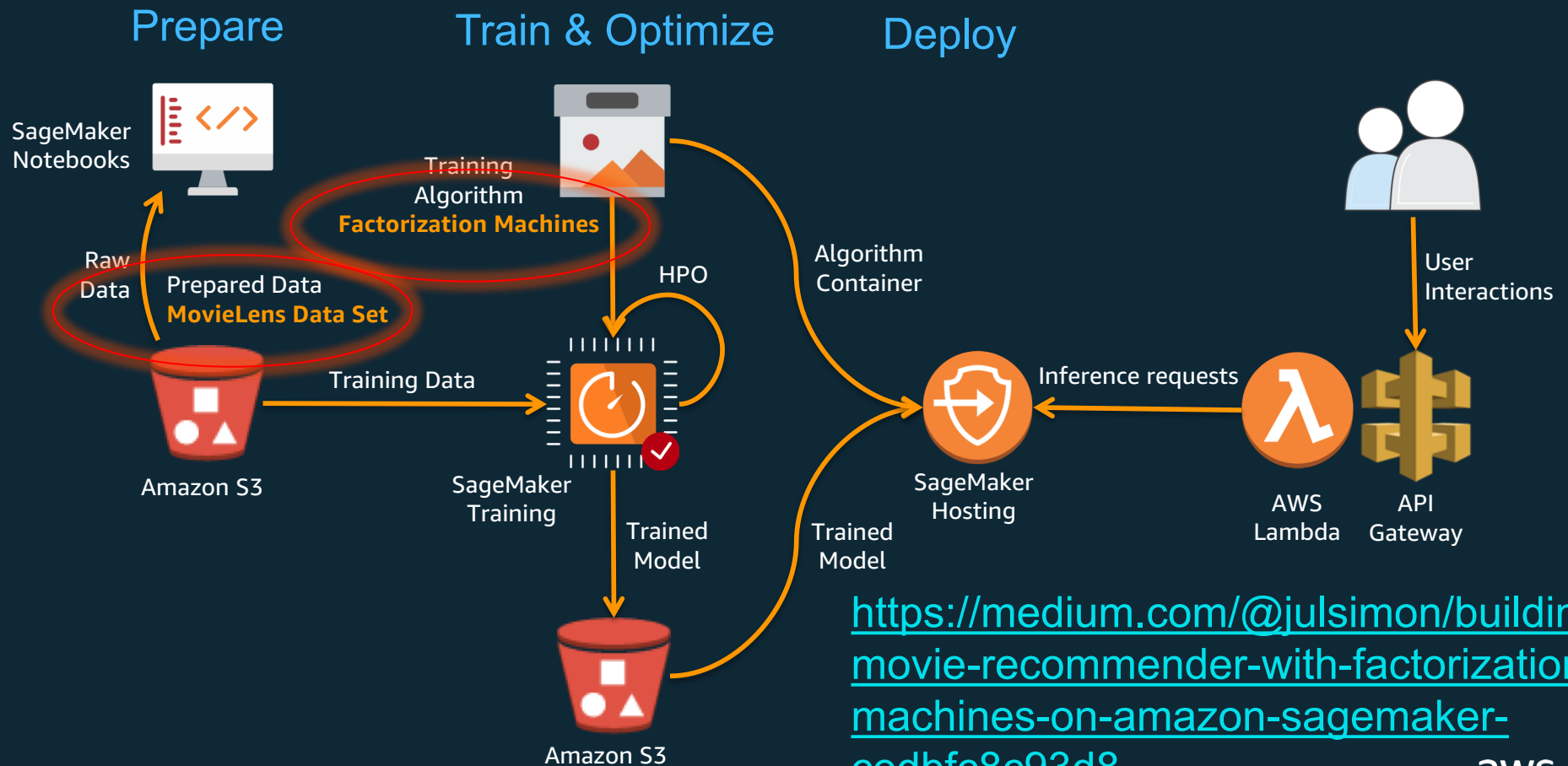- Sentiment Analysis
- Viewing patterns

Applications

- Content Discoverability/Recommendations
- Personalized Dynamic Ad-Insertions
- Content Viewing Experiences
- Content Production Investment Decisions

aws

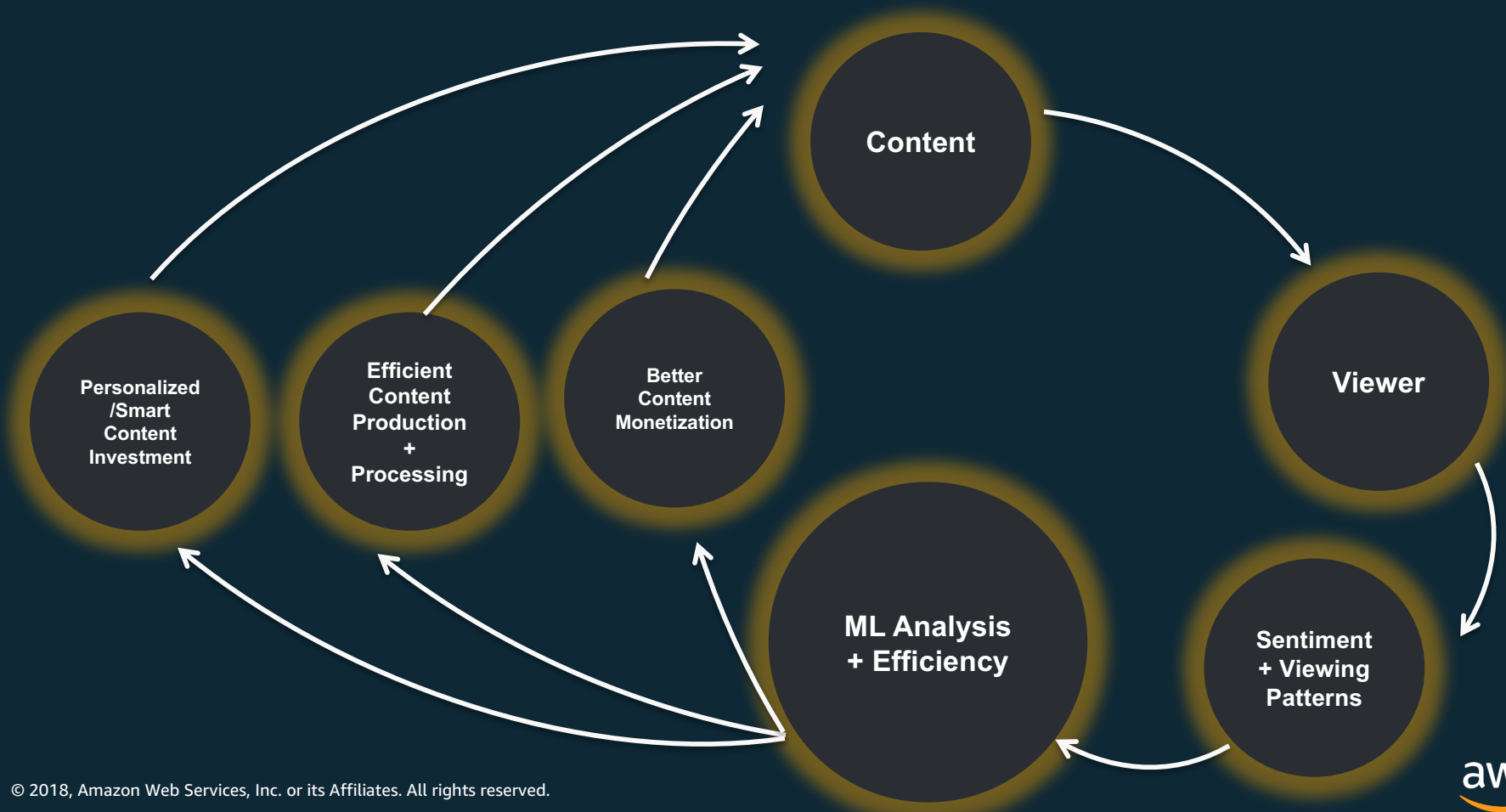# The new 'Entertainment interface' –
all about recommendations

aws

Recommendations Engine with Amazon Sagemaker

Prepare　　　　**Train & Optimize**　　　　**Deploy**

SageMaker
Notebooks

Training
Algorithm
Factorization Machines

Raw
Data

Prepared Data
MovieLens Data Set

Training Data

Amazon S3

HPO

SageMaker
Training

Algorithm
Container

Trained
Model

Trained
Model

Amazon S3

SageMaker
Hosting

Inference requests

User
Interactions

AWS
Lambda

API
Gateway

https://medium.com/@julsimon/building-a-movie-recommender-with-factorization-machines-on-amazon-sagemaker-cedbfc8c93d8

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Summing up

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ML Aided Content Flywheel

Content

Viewer

Personalized /Smart Content Investment

Efficient Content Production + Processing

Better Content Monetization

ML Analysis + Efficiency

Sentiment + Viewing Patterns

aws

Summing up

ML Platform to meet the needs of your business
- Flexibility
- Scalability

aws

Thank you and Build on!

aws