



Application and Deployment Services

EPISODE 11.01

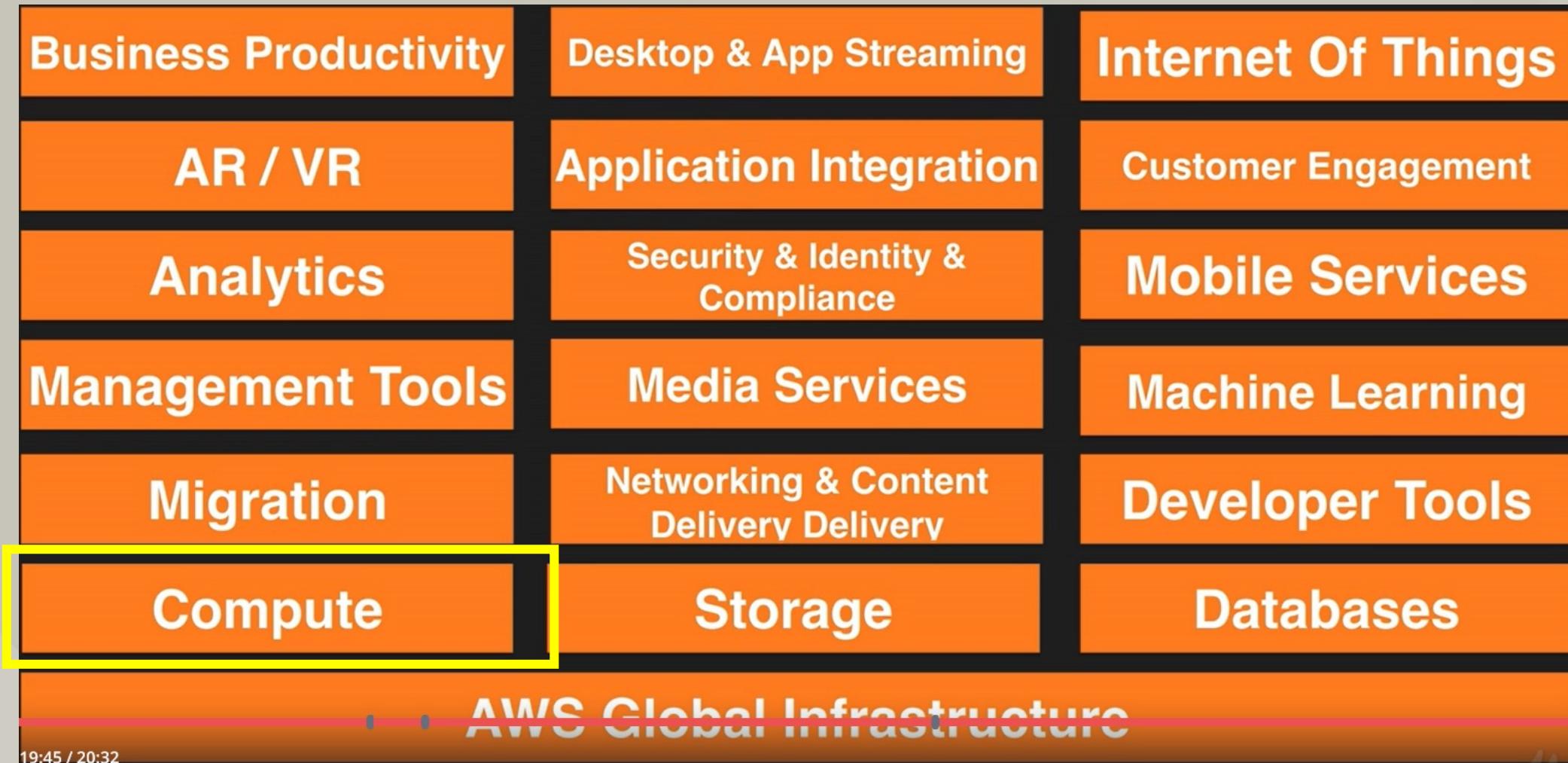
Business Productivity	Desktop & App Streaming	Internet Of Things
AR / VR	Application Integration	Customer Engagement
Analytics	Security & Identity & Compliance	Mobile Services
Management Tools	Media Services	Machine Learning
Migration	Networking & Content Delivery	Developer Tools
Compute	Storage	Databases

AWS Global Infrastructure

 Compute	 Management Tools	 AWS Cost Management	
EC2 Lightsail                                                                                  	 Management Tools	 AWS Cost Management	
CloudWatch AWS Auto Scaling CloudFormation CloudTrail Config OpsWorks Service Catalog Systems Manager Trusted Advisor Managed Services		AWS Cost Explorer AWS Budgets	
 Storage	 Mobile Services		
S3 EFS Glacier Storage Gateway	Mobile Hub AWS AppSync Device Farm		
 Database	 AR & VR		
RDS DynamoDB ElastiCache Neptune Amazon Redshift	Amazon Sumerian		
 Migration	 Application Integration		
AWS Migration Hub Application Discovery Service Database Migration Service Server Migration Service Snowball	Step Functions Amazon MQ Simple Notification Service Simple Queue Service SWF		
 Networking & Content Delivery	 Customer Engagement		
VPC CloudFront Route 53 API Gateway Direct Connect	Amazon Connect Pinpoint Simple Email Service		
 Developer Tools	 Business Productivity		
CodeStar CodeCommit CodeBuild CodeDeploy CodePipeline Cloud9 X-Ray	Alexa for Business Amazon Chime                                            	WorkSpaces AppStream 2.0	
 Analytics	 Internet of Things		
Athena EMR CloudSearch Elasticsearch Service Kinesis QuickSight                           	IoT Core IoT 1-Click IoT Device Management IoT Analytics Greengrass Amazon FreeRTOS IoT Device Defender		
 Security, Identity & Compliance	 Game Development		
IAM Cognito Secrets Manager GuardDuty Inspector Amazon Macie              	Amazon GameLift		
AWS Organizations AWS Single Sign-On Certificate Manager CloudHSM Directory Service WAF & Shield Artifact			

Lambda

EPISODE 11.02



Lambda

- AWS compute service that runs code without servers
- Runs code only when needed
- Scales automatically
 - Up to thousands of requests per second
- Billed by compute time

Automated Management

- Server maintenance
- Operating system maintenance
- Capacity scaling
- Code monitoring
- Logging

Languages Supported

- Node.js
- Java
- C#
- Go
- Python

Lambda Use Process

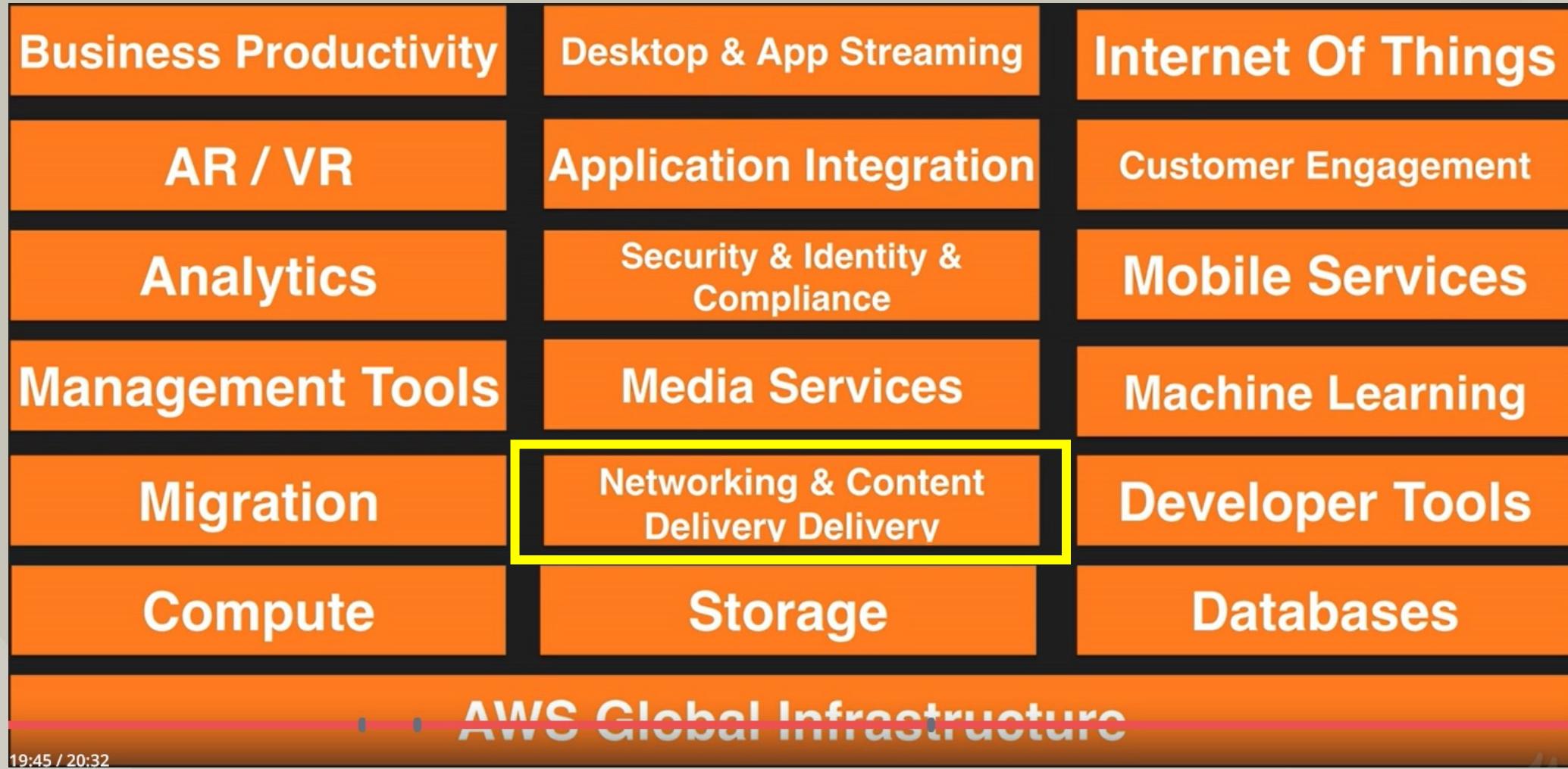
1. Customer builds the code
2. Customer launches the code as Lambda function
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4. Customer calls Lambda function as needed from applications

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API Gateway

EPISODE 11.03



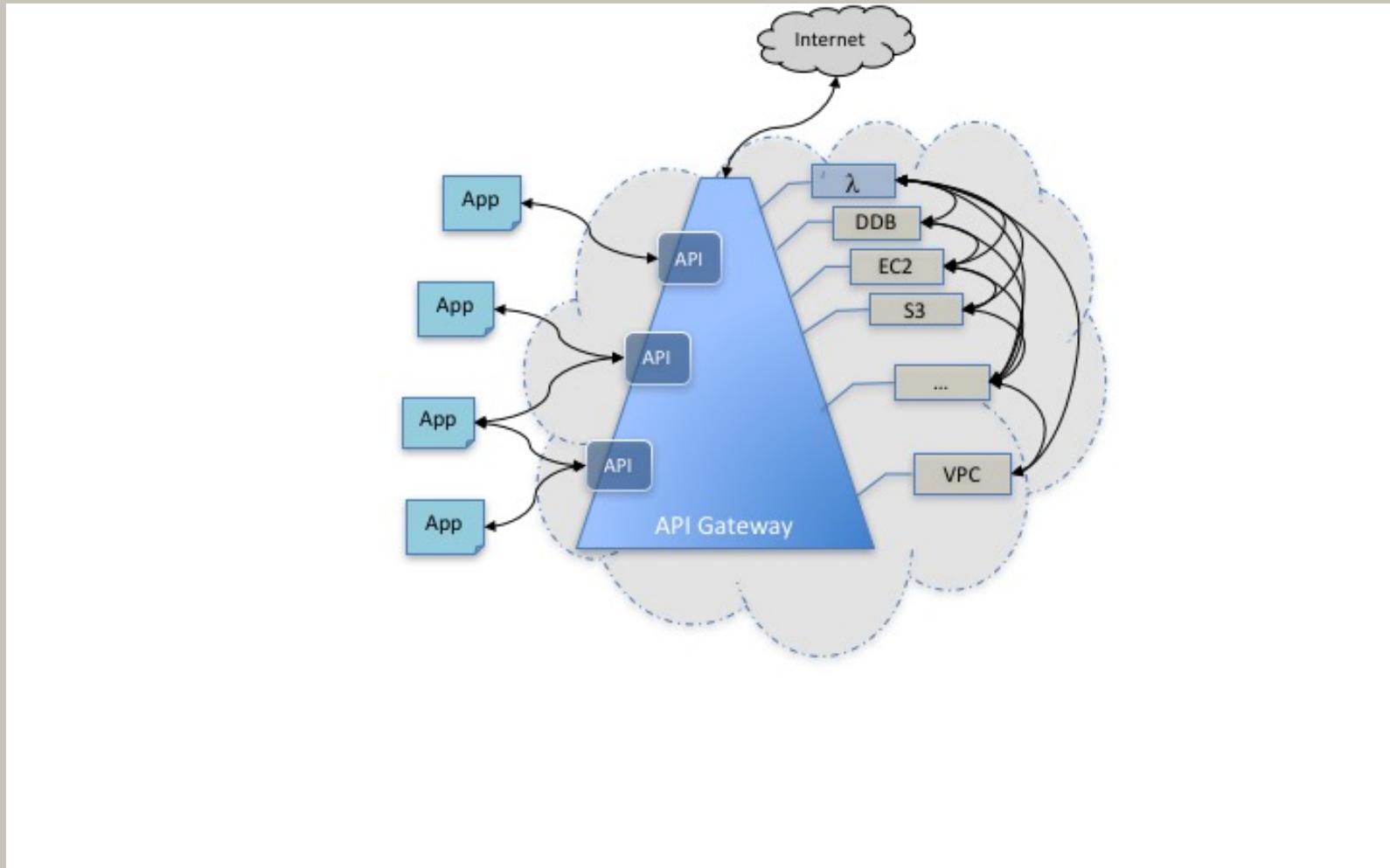
API Gateway

- API management in the cloud
 - Create
 - Publish
 - Maintain
 - Monitor
 - Secure

API Gateway

- APIs can interact with many targets
 - AWS services
 - Other web services
 - Data stored in AWS

API Gateway Architecture

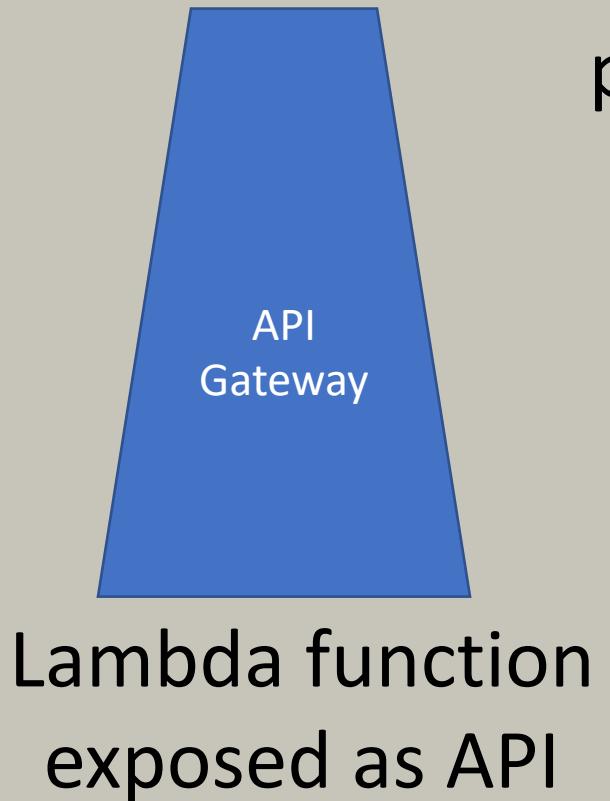
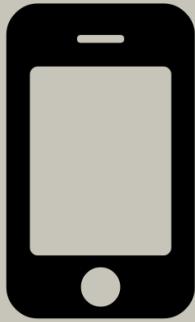


Serverless Architecture

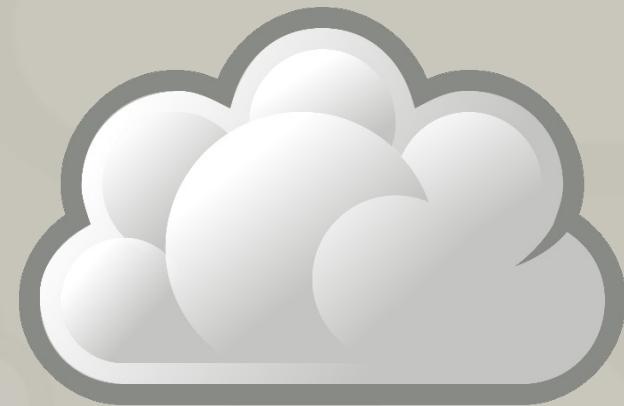
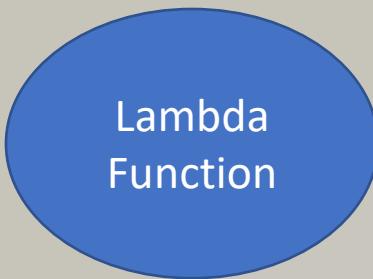
- Moves data in and out of the cloud without instances
- Process functions without instances
- Two primary services
 - Lambda
 - API Gateway

Serverless Architecture

Client talks to
API Gateway



Lambda function
processes input



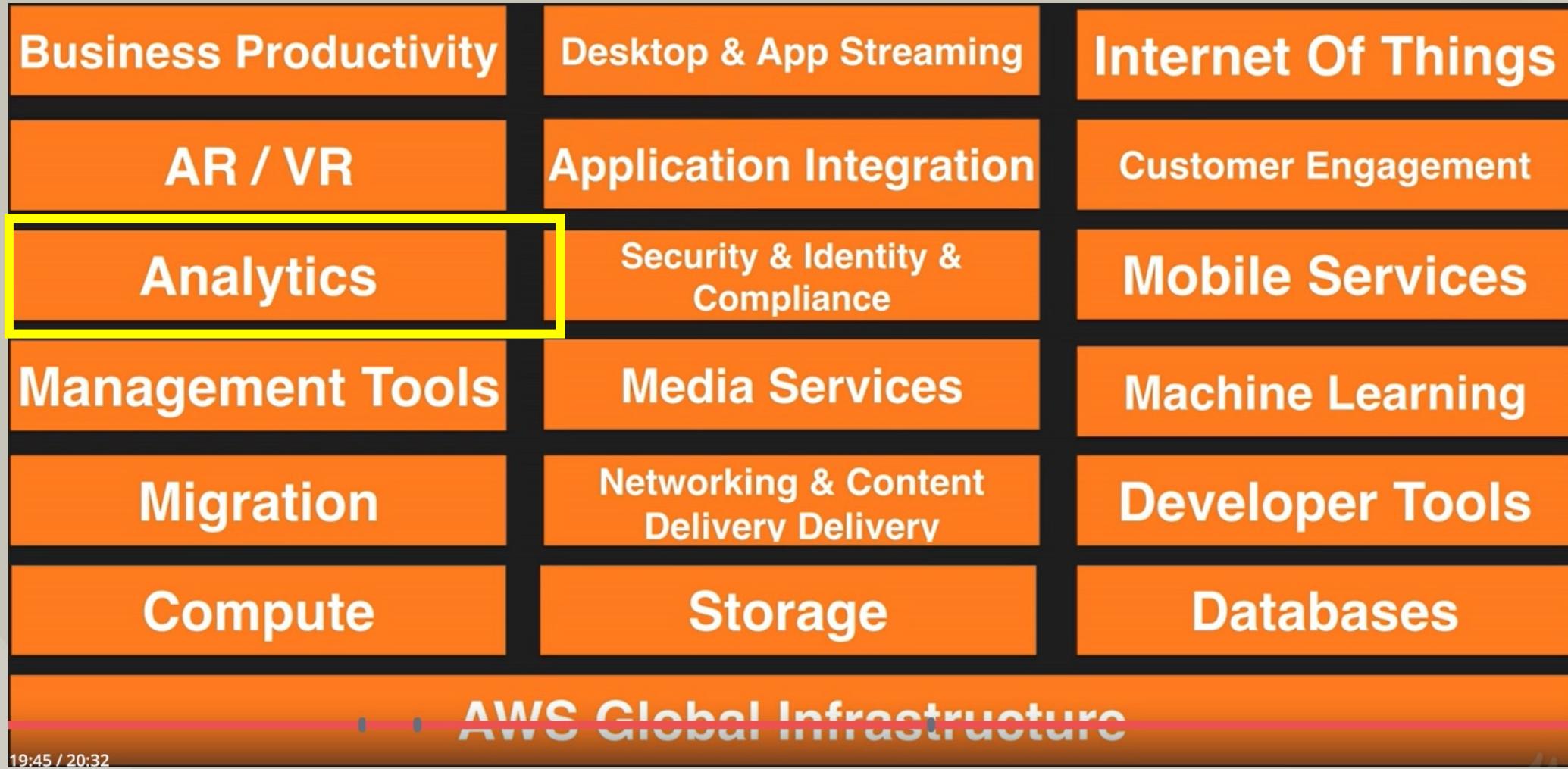
Lambda function forwards
results to another Internet
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Cross Origin Resource Sharing (CORS)

- Can be enabled for the API gateway
- Allows receipt of requests from other domains
 - Default is internal domain requests only
- Without it, errors will occur

Kinesis

EPISODE 11.04



Kinesis

- Processes streaming data
- Real-time analytics
- Multi-tier enabler
- Very DevOps focused
- Conceptual importance for an architect

Operating Modes

- Kinesis Data Streams
- Kinesis Data Firehose
- Kinesis Data Analytics
- Kinesis Video Streams
 - Media Services

Kinesis Benefits

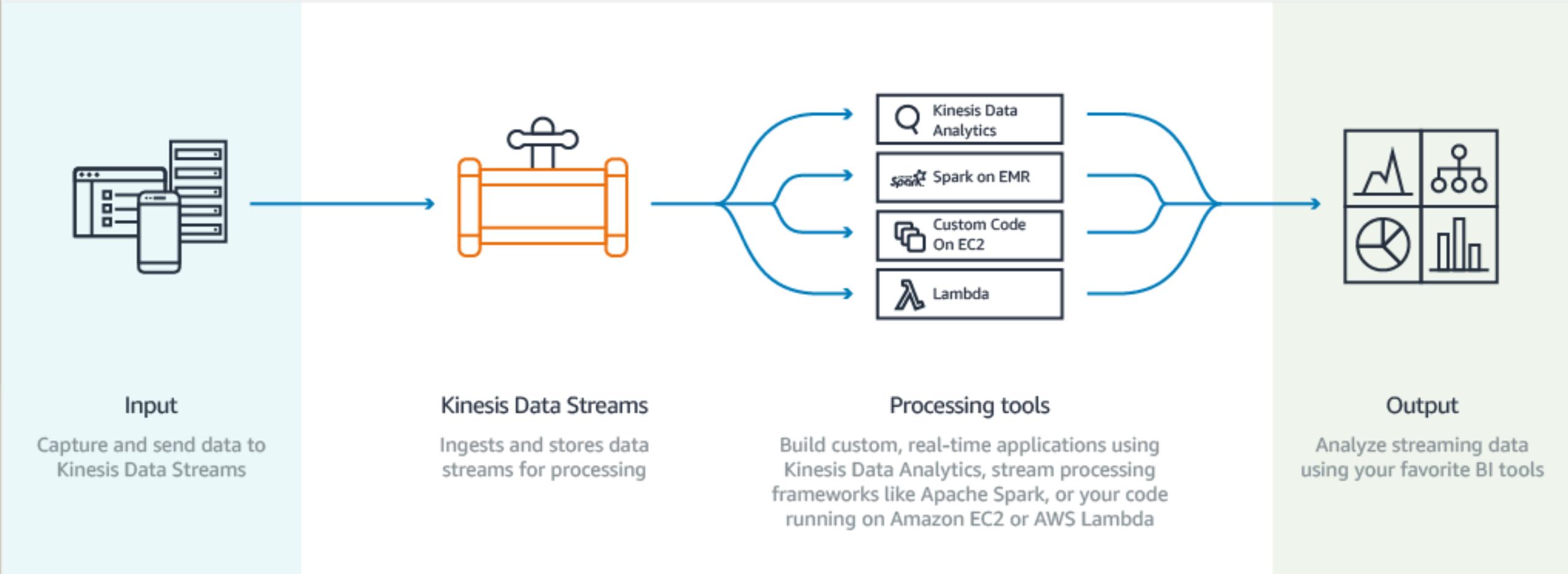
- Architecture fully managed
- No custom coding required
 - Configure producers
 - Configure consumers
 - Focus is on the analytics



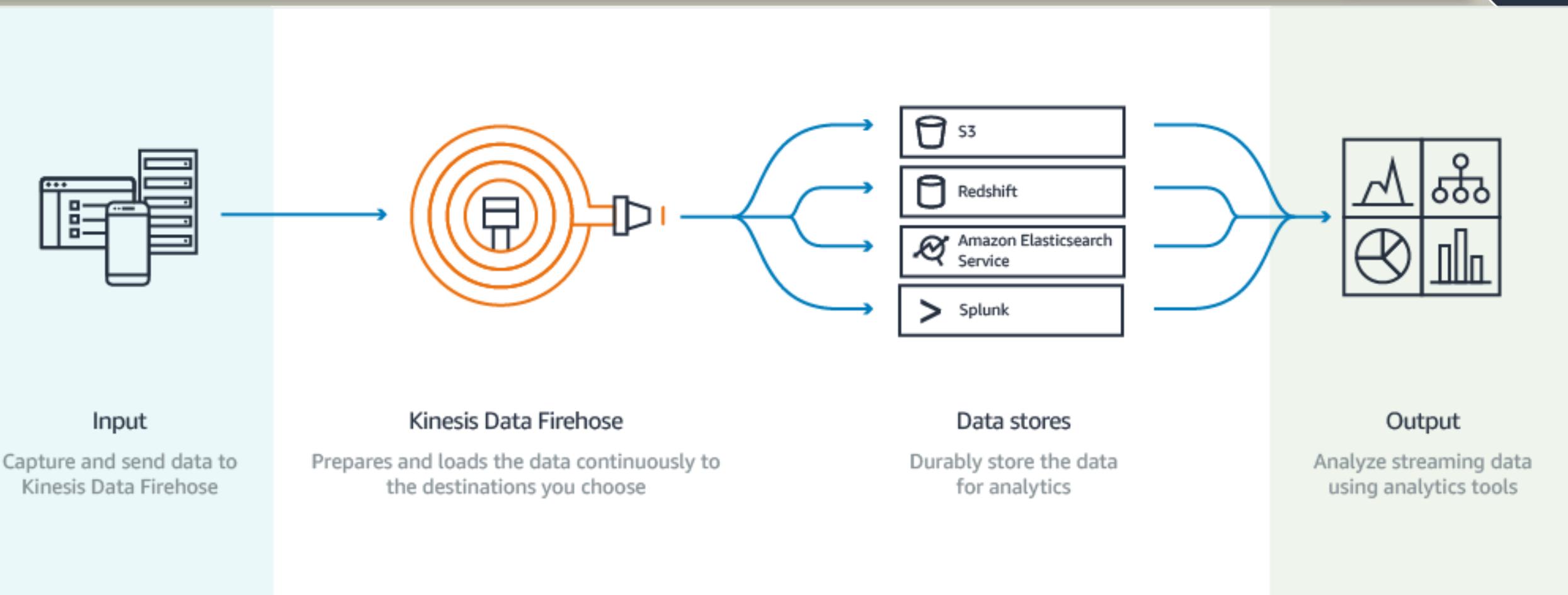
Kinesis Data Streams and Firehose

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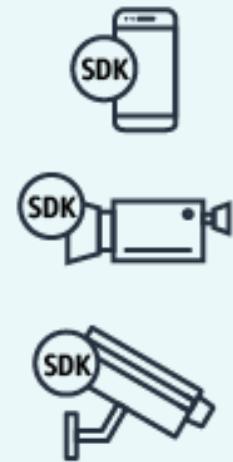
Kinesis Data Streams



Kinesis Data Firehose

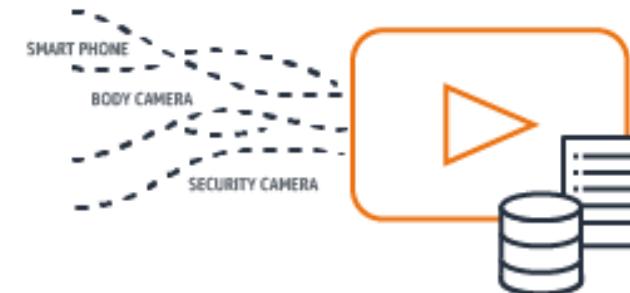
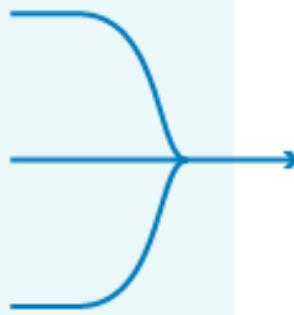


Kinesis Video Streams



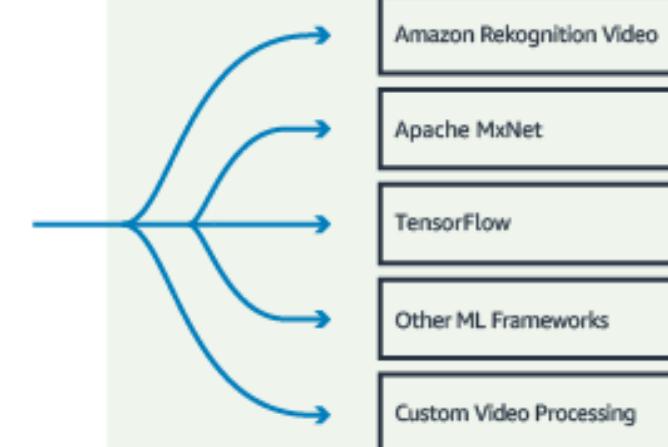
Input

Camera devices securely stream video to AWS using the Kinesis Video Streams SDK



Kinesis Video Streams

Ingests, durably stores, encrypts, and indexes video streams for real-time and batch analytics



Output

Machine learning, video processing, and media streaming services use Kinesis Video Streams APIs to access and retrieve indexed video fragments



Kinesis Data Analytics

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Kinesis Data Analytics

- Analyzes real-time data streams
- Based on standard SQL queries
- Supports concurrent consumers
 - Redshift
 - S3
 - Elasticsearch
 - Lambda
 - Kinesis Data Streams

Kinesis Data Analytics



Input

Capture streaming data
with Kinesis Data Firehose
or Kinesis Data Streams

Kinesis Data Analytics

Run standard SQL queries
against data streams

Output

Kinesis Data Analytics can send
processed data to analytics tools so
you can create alerts and
respond in real-time

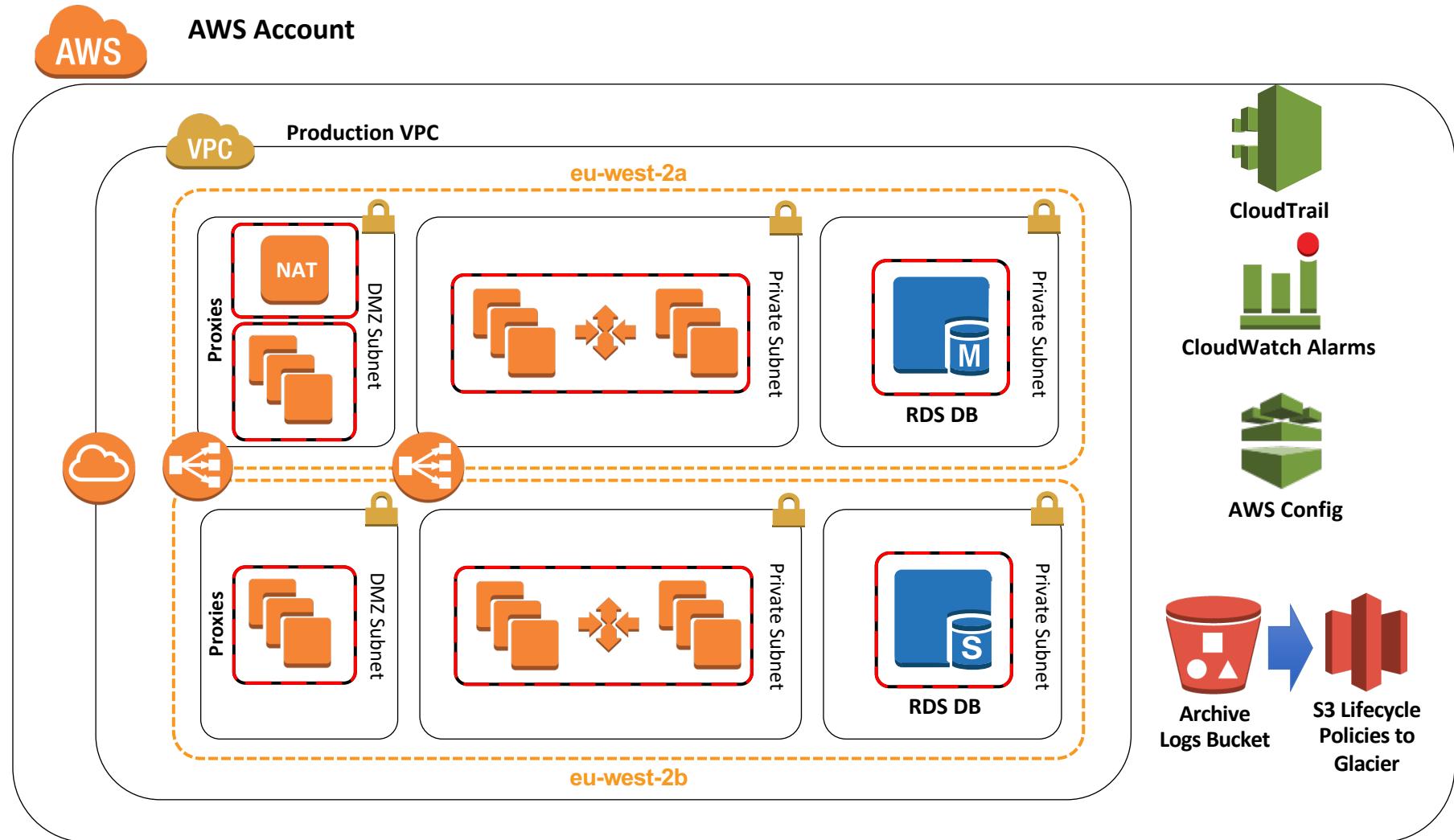
Reference Architectures

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Reference Architectures

- Well-architected frameworks
- AWS created architecture plans for specific scenarios
 - HIPAA
 - PCI-DSS
 - UK-OFFICIAL

Reference Architecture



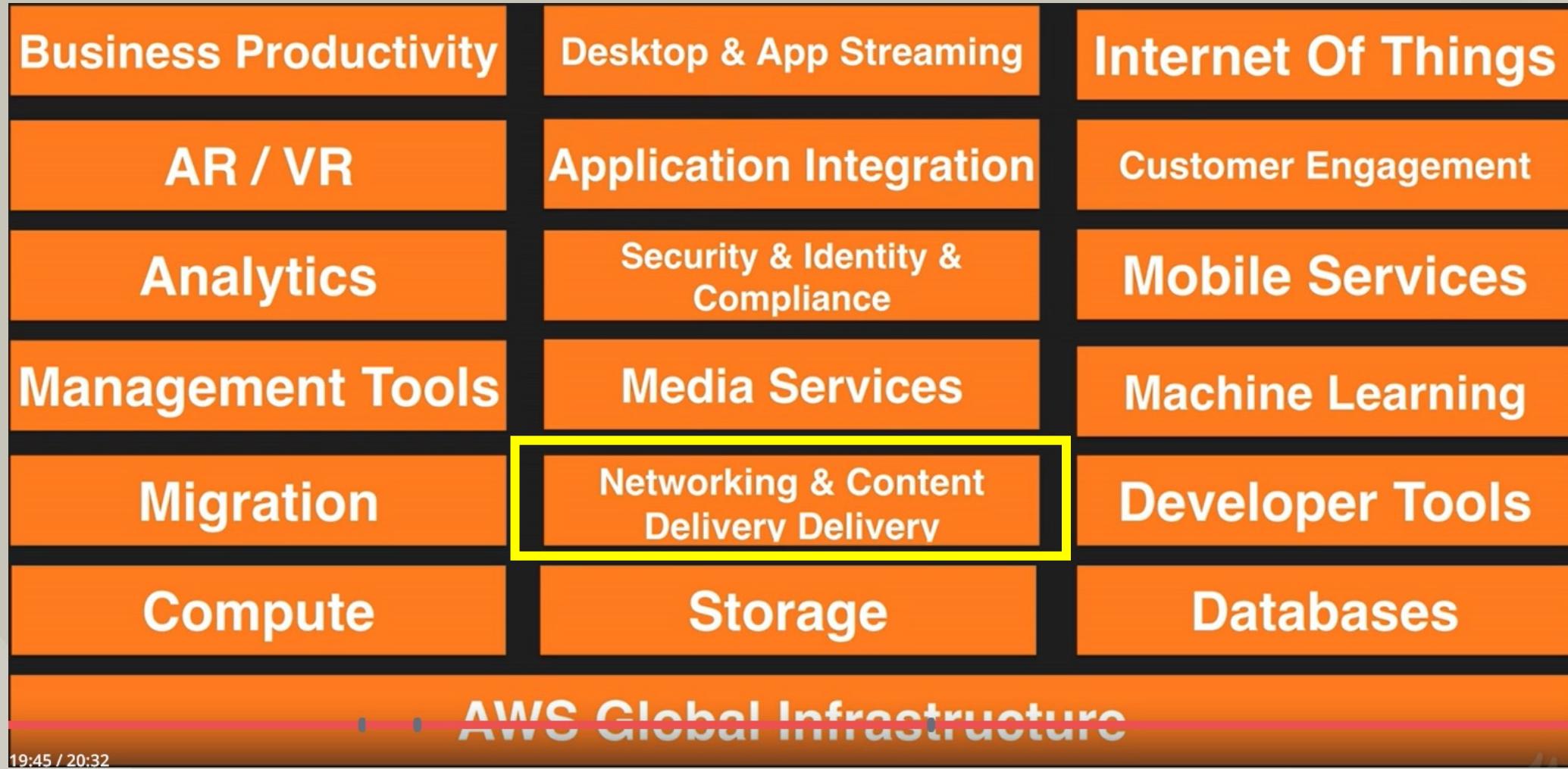
<https://docs.aws.amazon.com/quickstart/latest/compliance-hipaa/overview.html>

DEMO

- PCI-DSS Architecture
 - <https://docs.aws.amazon.com/qickstart/latest/compliance-pci/welcome.html>
- All the QuickStart Reference Architectures
 - <https://aws.amazon.com/quickstart/>

CloudFront

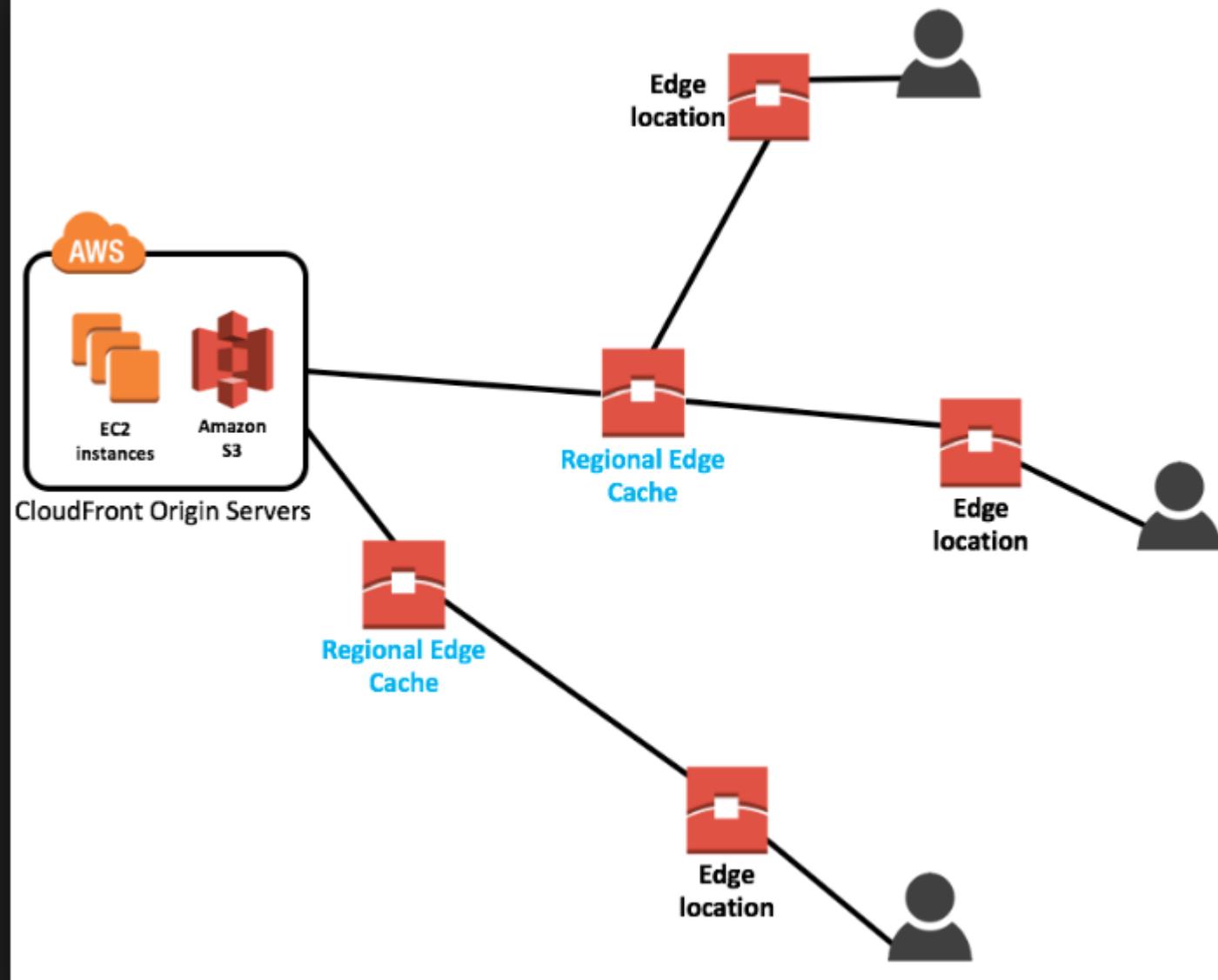
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CloudFront

- Content delivery network (CDN)
 - Distributes content to localized regions
 - Reduces latency
 - Provides high data transfer speeds

CloudFront in Action



- Regional edge caches
- Edge locations

Demo

- Use Cases
- <https://docs.aws.amazon.com/AmazonCloudFront/latest/DeveloperGuide/IntroductionUseCases.html>

Implementation Considerations

- Content source
 - S3
 - MediaPackage channel
 - HTTP server
- Content access
 - Public
 - Restricted
- Content constraints
 - HTTPS required
 - Geo-restrictions

Web Application Firewall (WAF)

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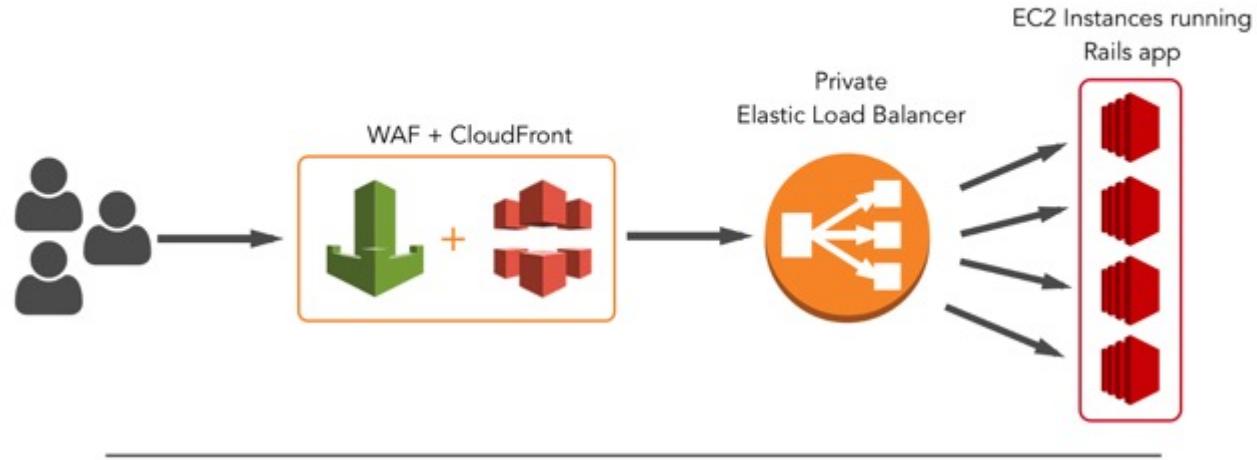
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Web Application Firewall (WAF)

- Controls access to HTTP and HTTPS servers
 - Based on requests
 - Based on source IPs

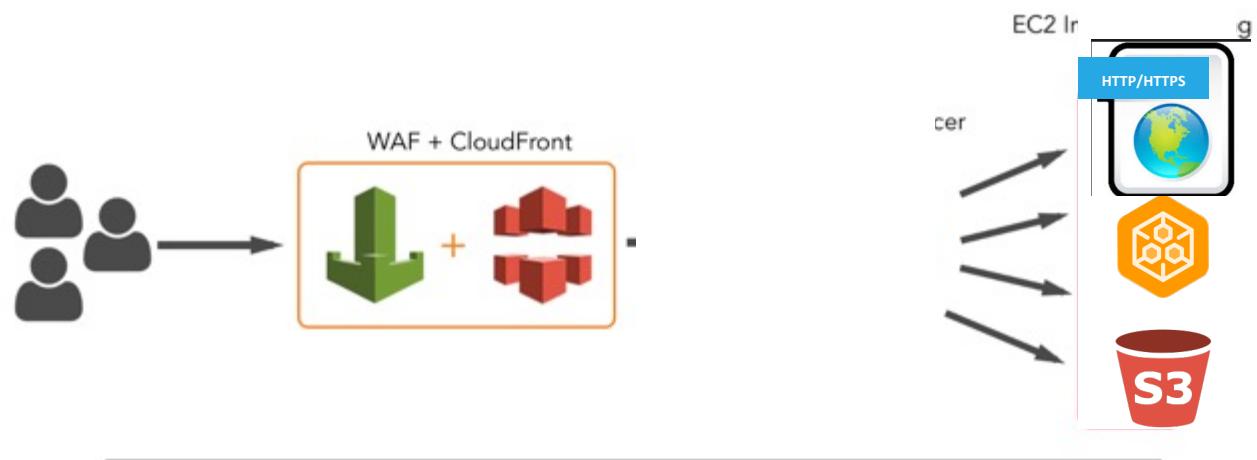
Web Application Firewall (WAF)

Firewall Architecture with CloudFront + WAF



- Works with CloudFront and/or Load Balancers

Firewall Architecture with CloudFront + WAF



WAF Behaviors

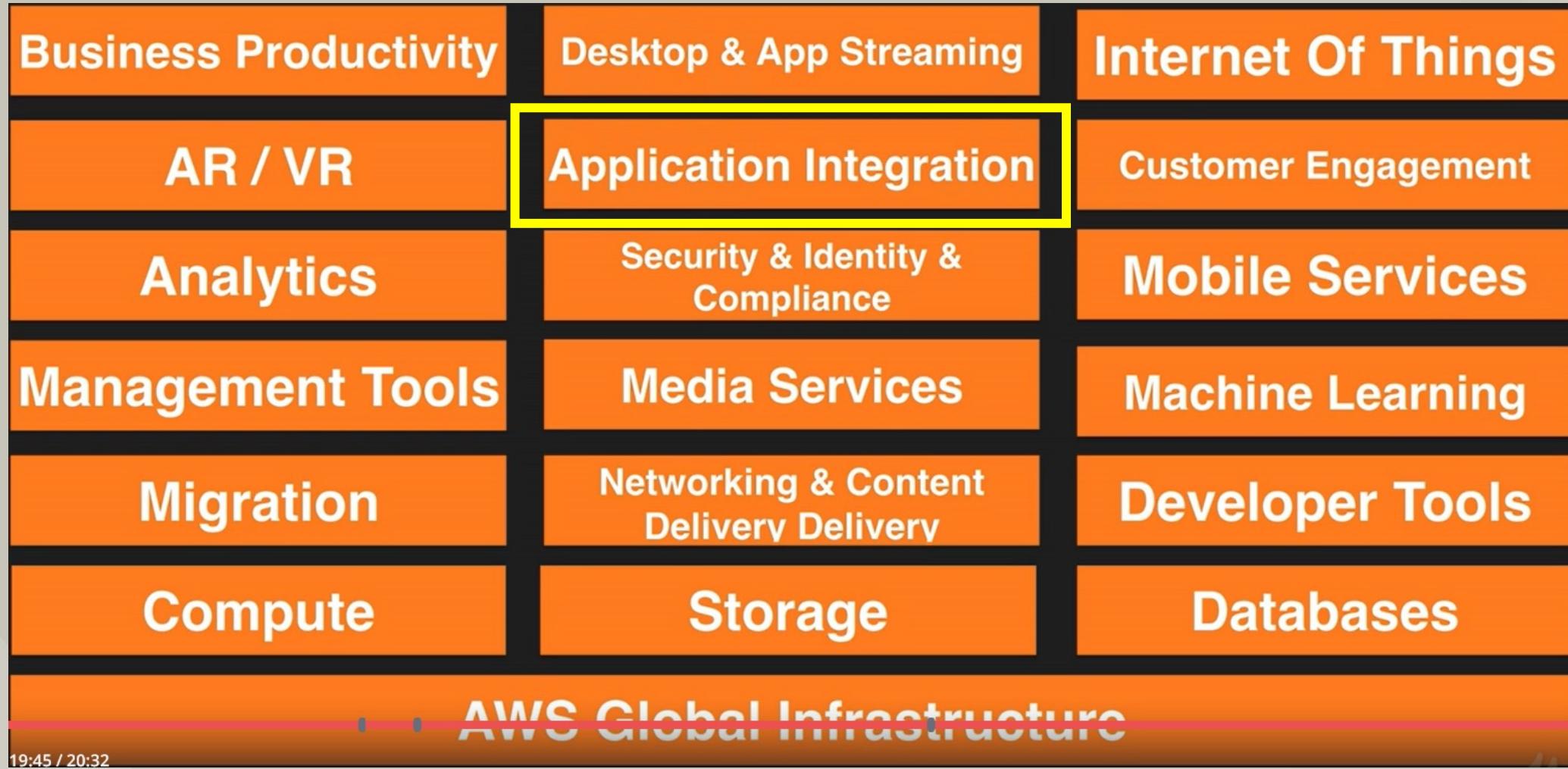
- Allow all requests
 - Except the ones that you specify
- Block all requests
 - Except the ones that you specify
- Monitoring
 - Requests that match specified parameters

WAF Operations

- Error handling
 - HTTP 403 error (forbidden)
- Configurable default behavior
 - What happens when the request doesn't match any rules?
 - Allow
 - Deny

Simple Queue Service (SQS)

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Simple Queue Service (SQS)

- Used to decouple applications
 - Break application into separate processing tasks
 - Allows many small processes to form a complete solution

SQS Messages

- Outputs from other processes
- Inputs to other processes
- Queued and processed asynchronously
 - Non-linear
- Up to 256 KB data
 - Record pointers, directives, parameters

SQS Participants

- Message producers
- Message consumers
- Messaging service
 - SQS

SQS Features

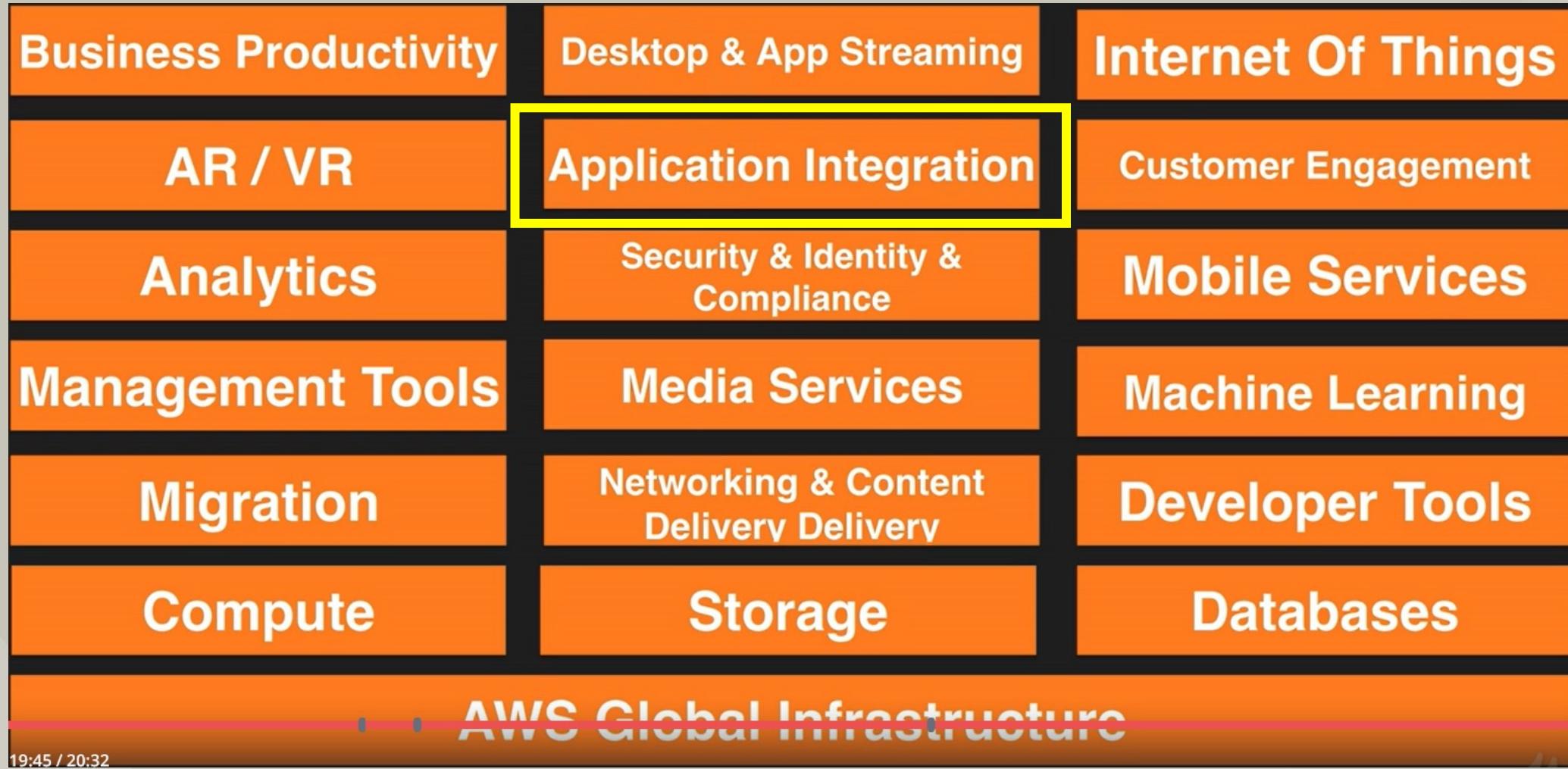
- Redundant across multiple AZs
 - Queued until processed
 - Retention up to 14 days
- Automatically scales

SQS Queue Types

- Standard
 - Default queue type
 - Doesn't guarantee sequential delivery of messages
- First-In-First-Out (FIFO)
 - Guarantees sequential delivery of messages
 - Supports fewer transactions per second

Simple Notification Service (SNS)

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Simple Notification Service (SNS)

See notes

- Paging in the cloud
- Uses the publish-subscribe mechanism based on “topics”
 - Called pub-sub messaging

Publishers

- Publishers push messages to topics
 - Topic examples:
 - Admin alerts, performance alerts, etc.
 - Publisher examples:
 - CloudWatch, Cost Explorer, etc

Subscribers

- Clients receiving notifications
- Receive all messages broadcasted to the topic
- Publishers and subscribers aren't "aware" of each other

SNS Features

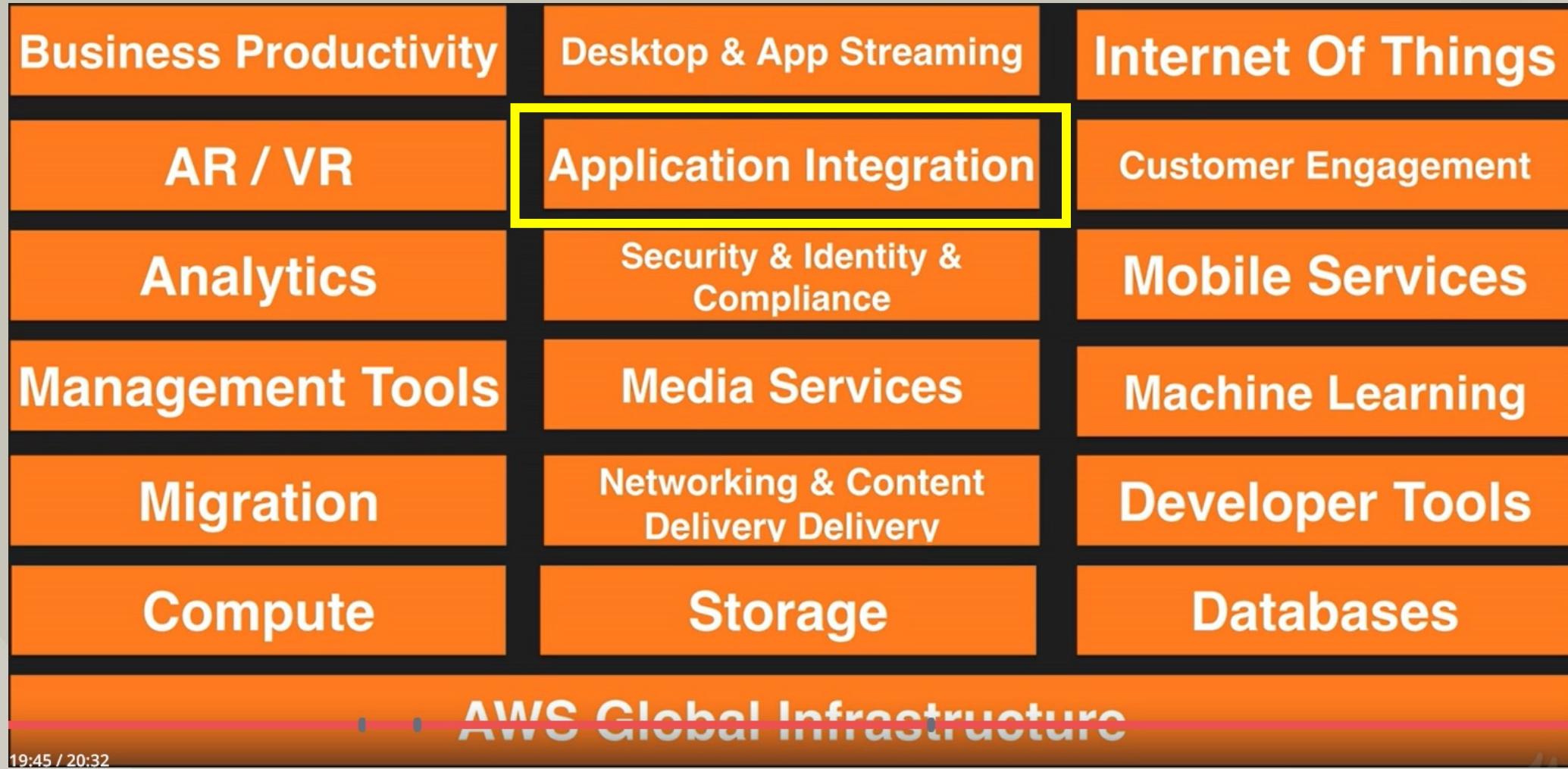
- Stored across multiple AZs
- Several delivery options supported
 - HTTP/HTTPS
 - E-Mail
 - SMS (Short Message Service)
 - Lambda
 - SQS

SNS Message Limits

- Up to 256 KB of data
- Special SMS constraints:
 - Max size of single SMS is 140 bytes
 - Larger messages sent as multiple transmissions
 - Aggregate SMS size is 1600 bytes

Simple Workflow (SWF)

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Simple Workflow (SWF)

- Defines the sequence of events required to achieve a workflow
- Used in decoupled applications

Workflow

- Activities that result in a desired objective
- Logic that controls the activities
 - Decider function determines best workflow
- Operates in a domain
 - Created logical boundary in SWF to constrain the scope of the activities

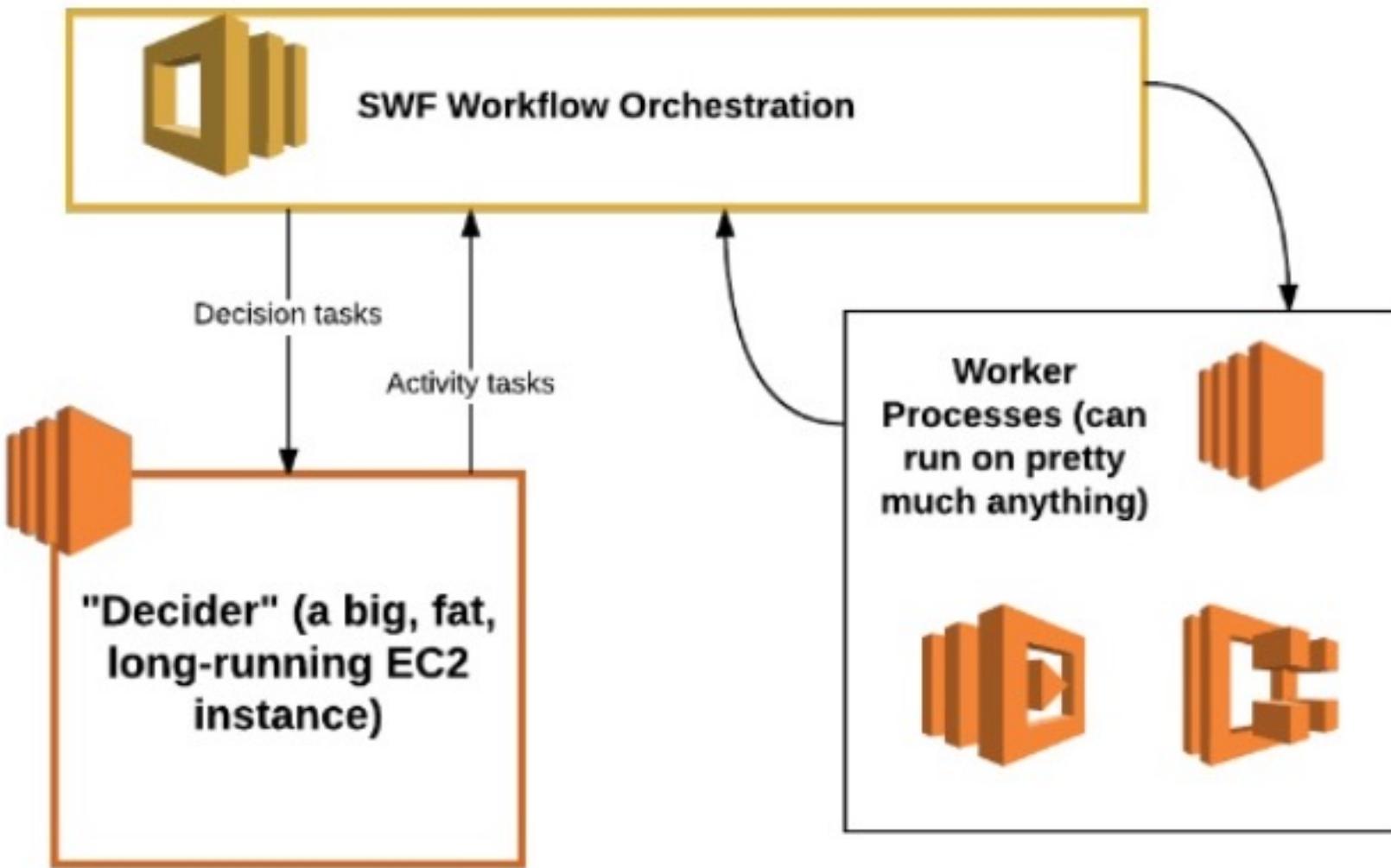
SWF Activity Tasks

- One invocation of an activity
 - For example, processing an order
- May be invoked multiple times
 - For example, processing a multi-item order

SWF Activity Workers

- The applications that receives and processes activity tasks

TRADITIONAL SWF ARCHITECTURE



Step Functions

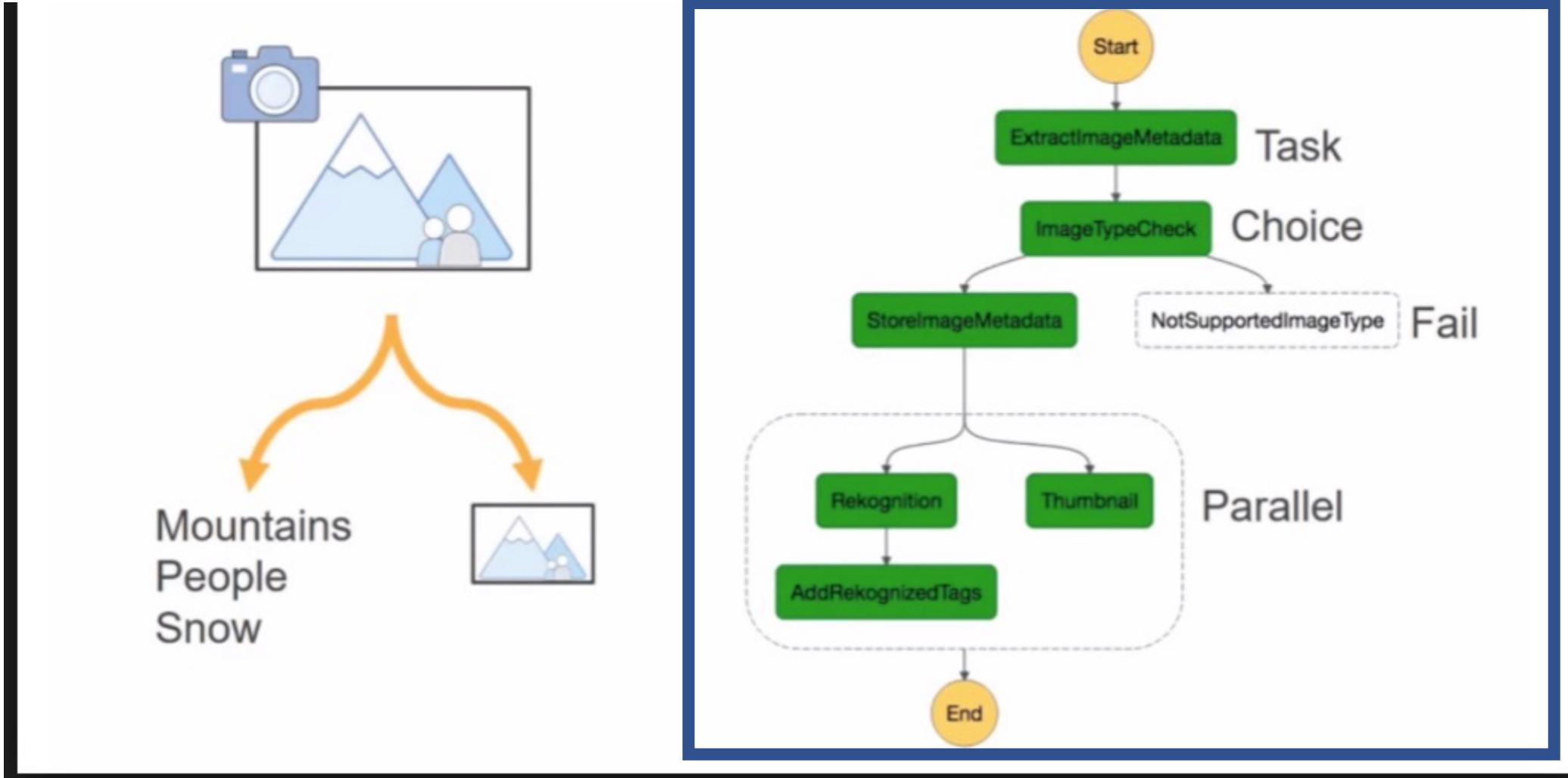
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Step Functions

- AWS recommended practice
 - Eventually replacing SWF
- Similar to SWF in functionality
 - Uses state machines
 - Decider
 - Activity tasks
 - Worker tasks

Step Functions State Machine

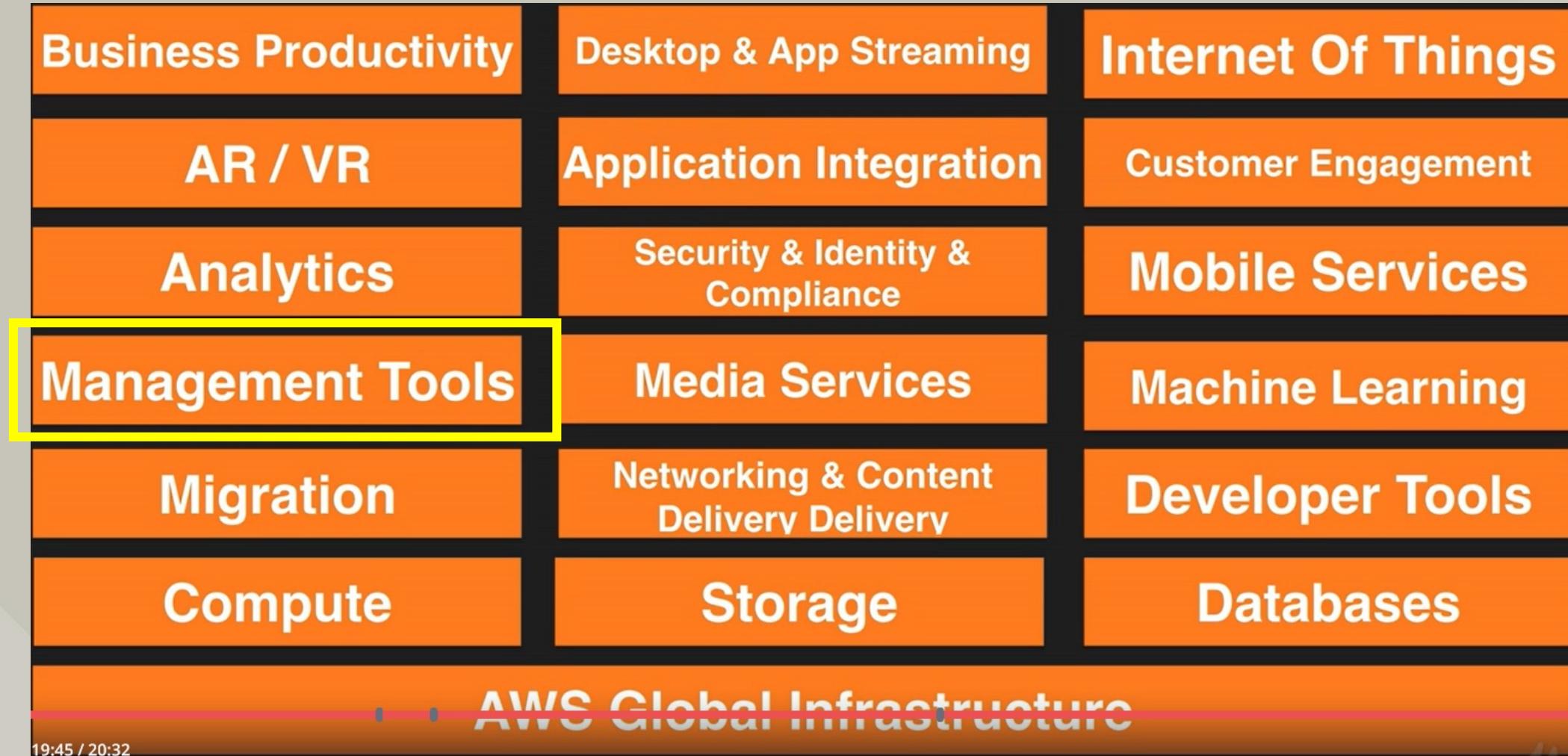
State Machine



OpsWorks

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OpsWorks

- Configuration management service
 - Configure (code-based)
 - Instance deployment
 - Service deployment
 - Application deployment
 - Operate
 - Application updates
 - Infrastructure updates
- Automated deployment

OpsWorks Stacks

- Initial OpsWorks mode
- Collection of layers
 - Any AWS service
 - Any runtime environment

OpsWorks Chef Automate

- Cookbooks contain recipes
- Recipes equivalent to layers
 - Defined configuration settings
 - Admin defined
 - AWS defined
 - Third-party defined

OpsWorks Puppet

- Master servers
 - Pre-configured modules
 - Modules equivalent to layers

Prebuilt Layers

- Ruby
- PHP
- Node.js
- Java
- Amazon RDS
- HA Proxy
- MySQL

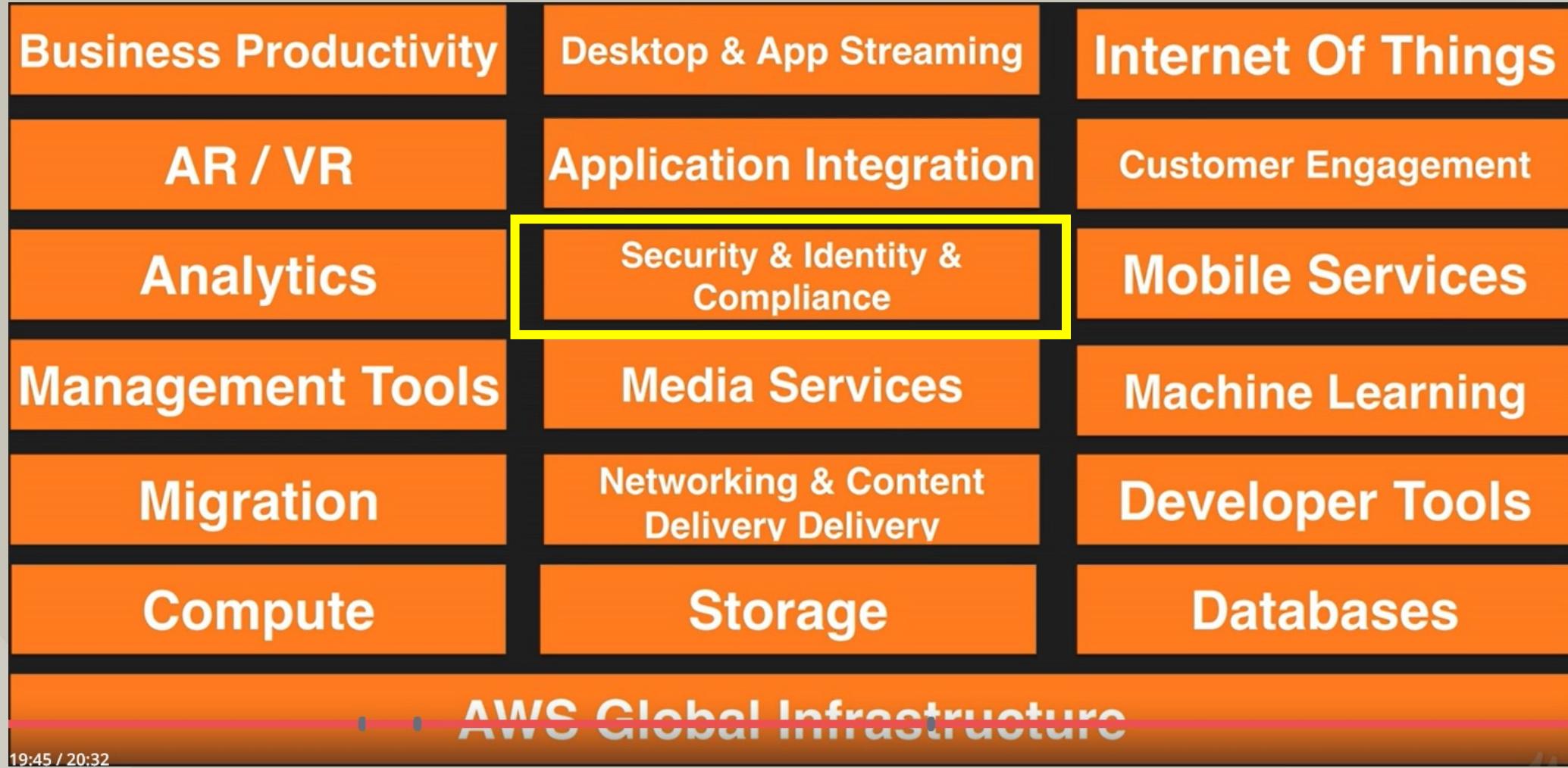
Use Cases

- In the cloud:
 - Chef
 - Puppet
- On-premises (local):
 - Stacks

Cognito

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Cognito

- User identity and data synchronization service
 - SSO
- Public identity providers
 - Google
 - Facebook
 - Amazon
- Private identity providers
 - Active Directory with SAML

Identity Management

- Based on open standards
 - OAuth 2.0
 - SAML 2.0
 - OpenID connect
- Profile management
- Scales to millions of users

AWS Integration

- Cognito controls access to AWS resources
 - Define roles
 - Map users to roles

Elastic MapReduce (EMR)

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Business Productivity	Desktop & App Streaming	Internet Of Things
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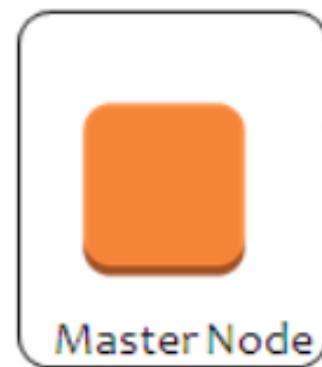
- Distributes processing across clusters
 - Implements a managed Hadoop framework
- Pulls data from S3 buckets
- Uses EC2 instances
- User defines the number of needed clusters

EMR Cluster Nodes

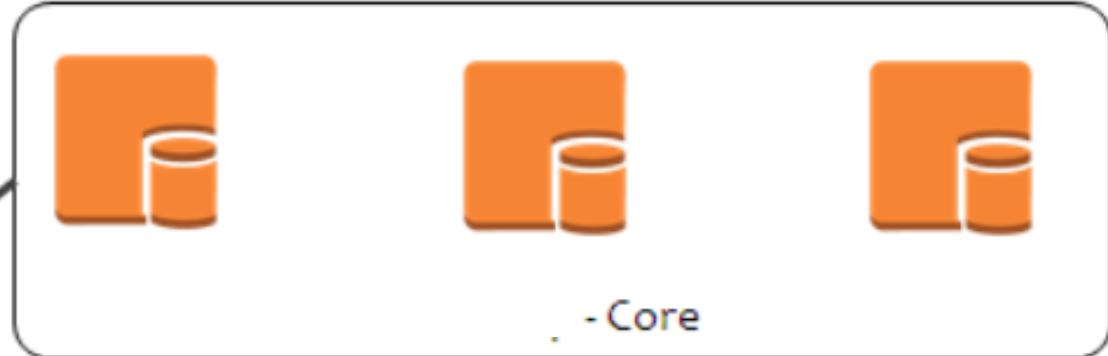
- Master
 - Coordinates job distribution across core and task nodes
- Core
 - Runs tasks assigned by the master node
 - Stores data in the cluster
- Task
 - Runs only tasks that do not store data

Pin it

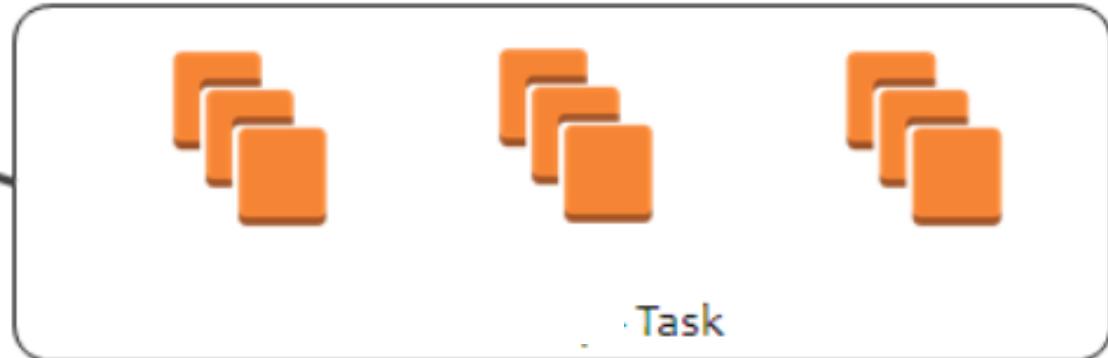
AWS



Storage/processing



Processing only

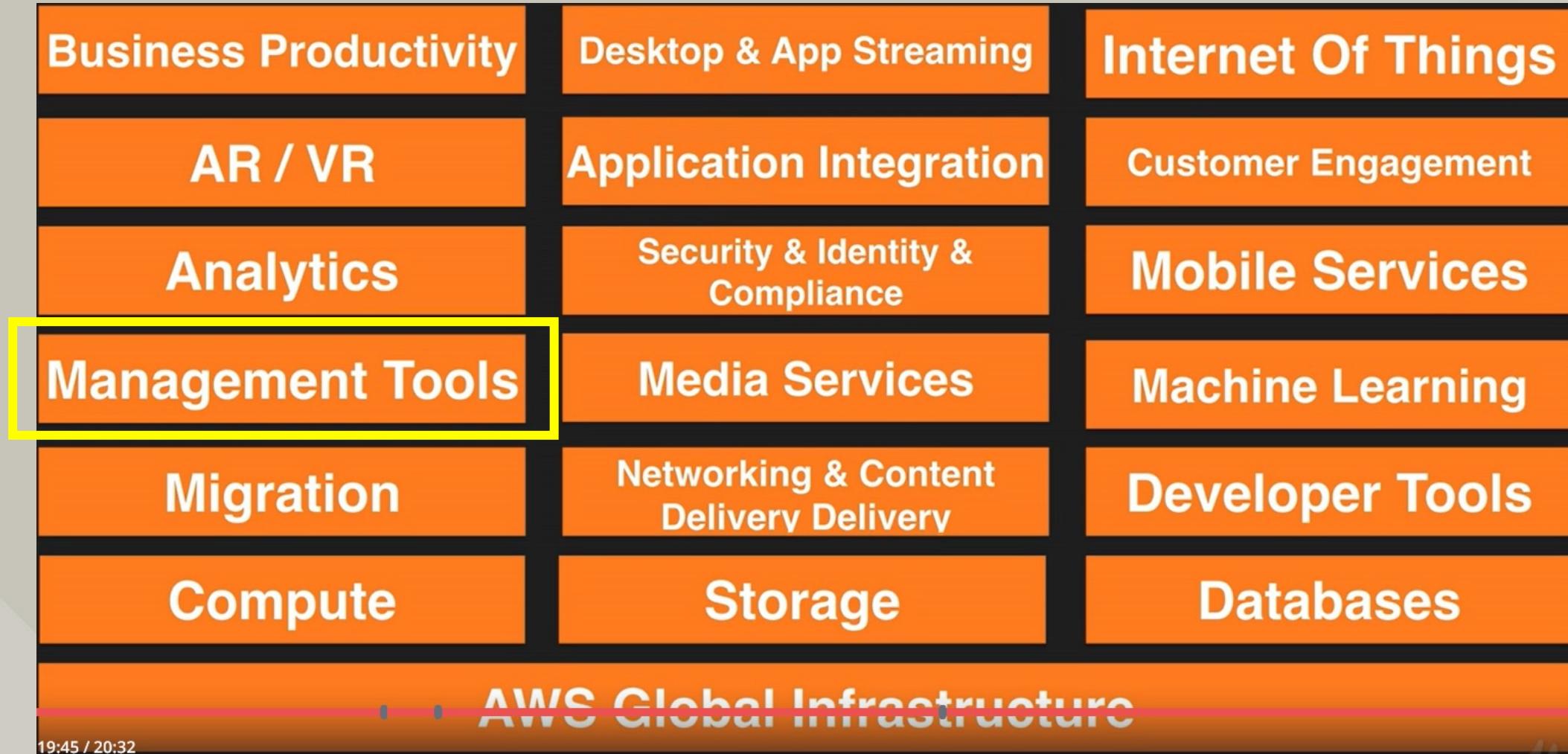


AWS cloud

CloudFormation

EPISODE 11.17





CloudFormation

- Graphical interface
- Uses templates to build entire solutions in AWS
 - EC2 instances
 - Security groups
 - Subnets
 - IAM users and roles
 - Etc.

CloudFormation

- Components:
 - Templates
 - Build the stacks
 - Stacks
 - Implementation of templates
 - Change sets
 - Modify stacks

CloudFormation

- Why use it?
 - Rapid deployment
 - Mirror existing internal architectures
 - Take advantage of templates created by others

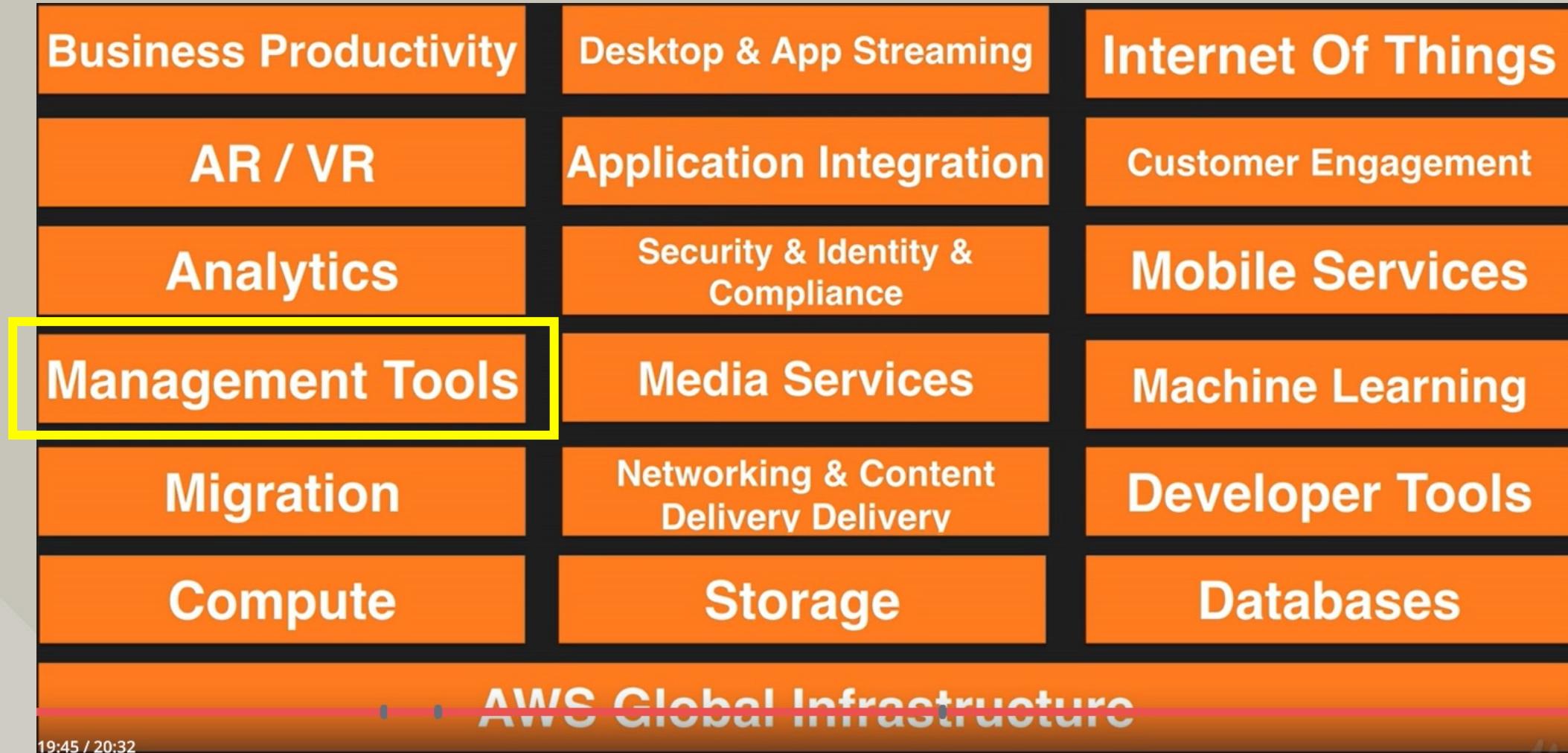
DEMO

- CloudFormation

CloudWatch

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CloudWatch

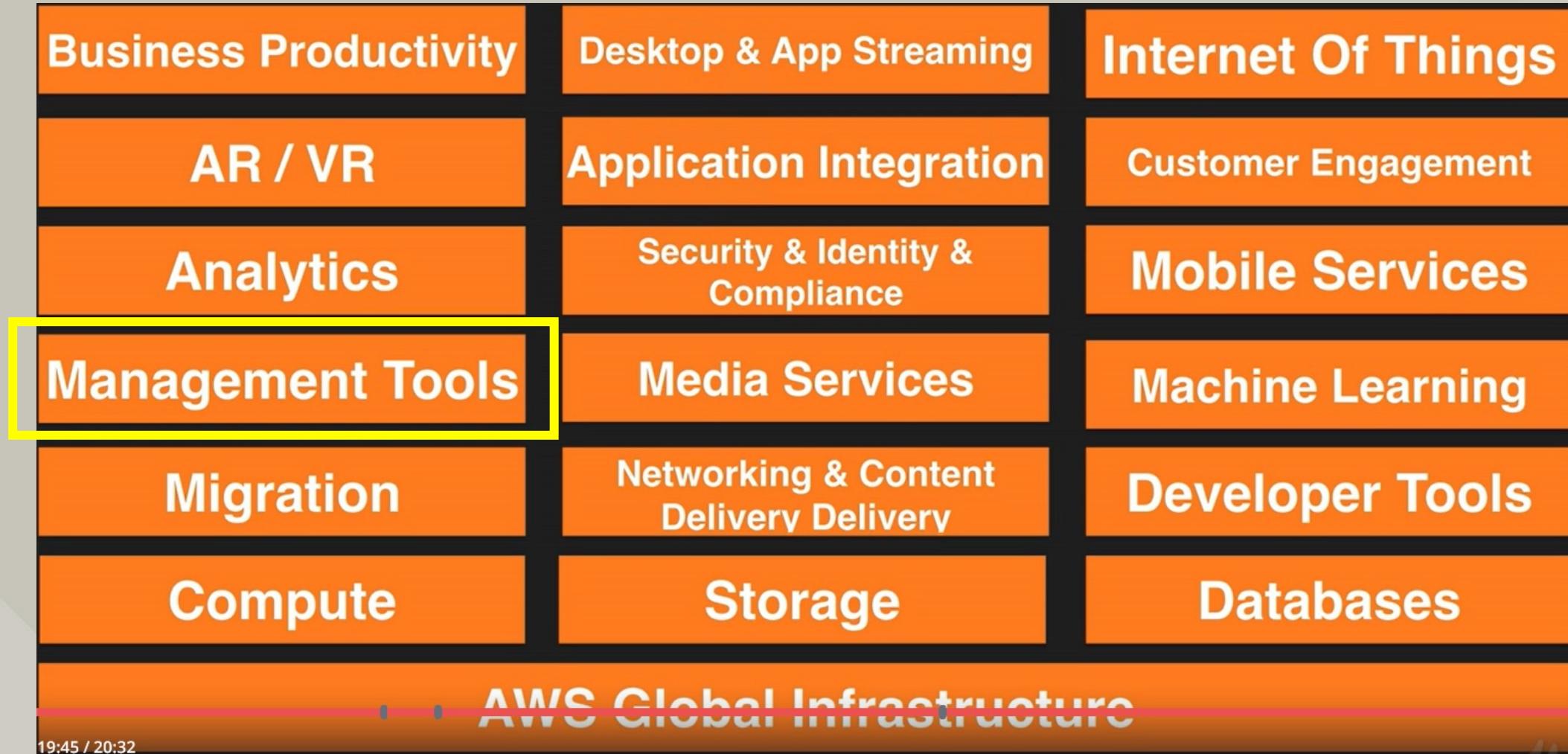
- Monitors the cloud and on-premises systems
- Dashboards
- Logs
- Events
- Alarms

CloudWatch

- Why use it?
 - Monitor critical systems
 - Receive notifications related to performance and security
 - Push on-premises logs into the cloud
 - Take automatic actions based on alarms

Trusted Advisor

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Trusted Advisor

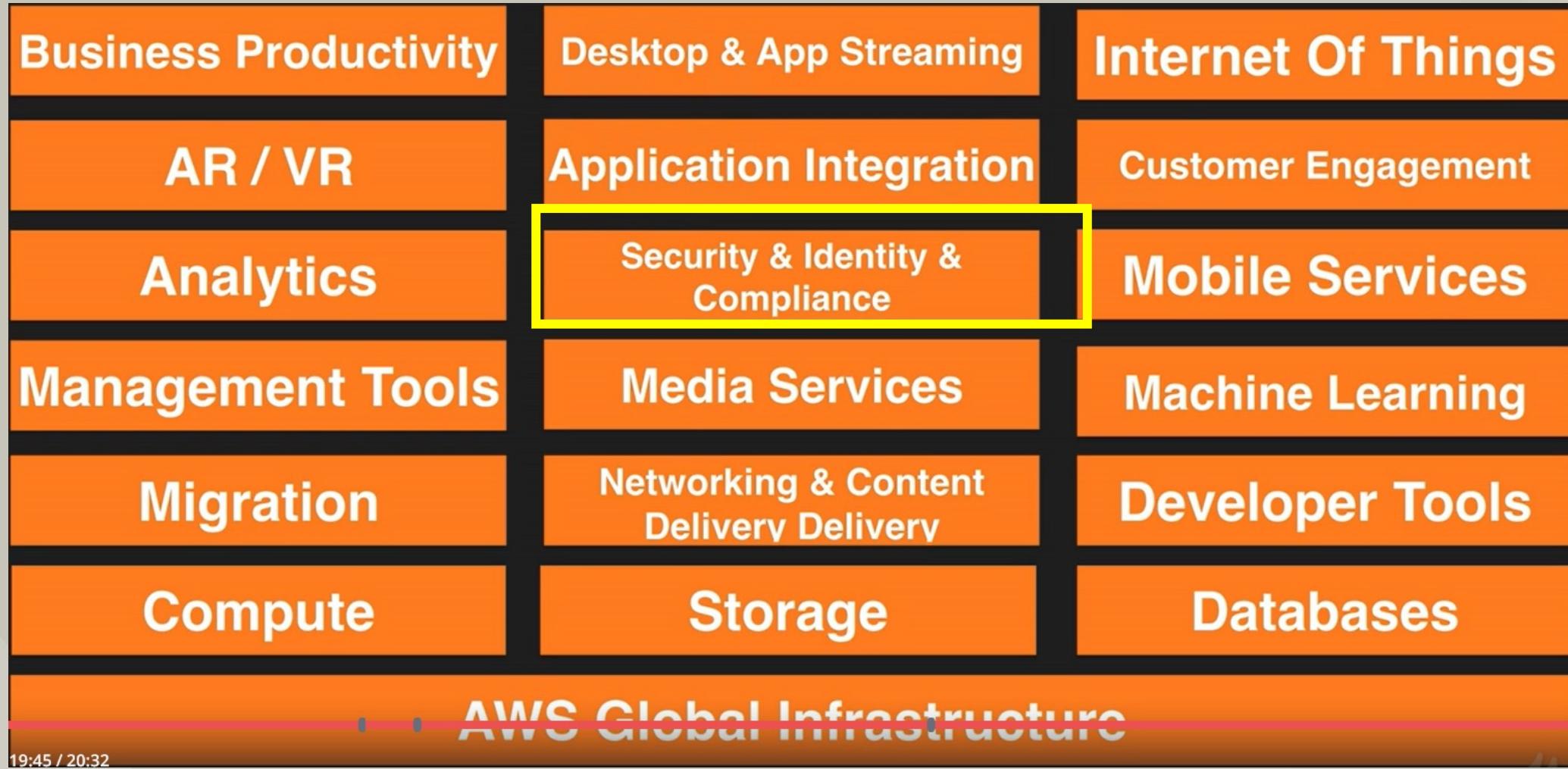
- Recommendations for security and other issues
- Scans the AWS cloud for recommendations

DEMO

- The Trusted Advisor interface

AWS Organizations

EPISODE 11.20



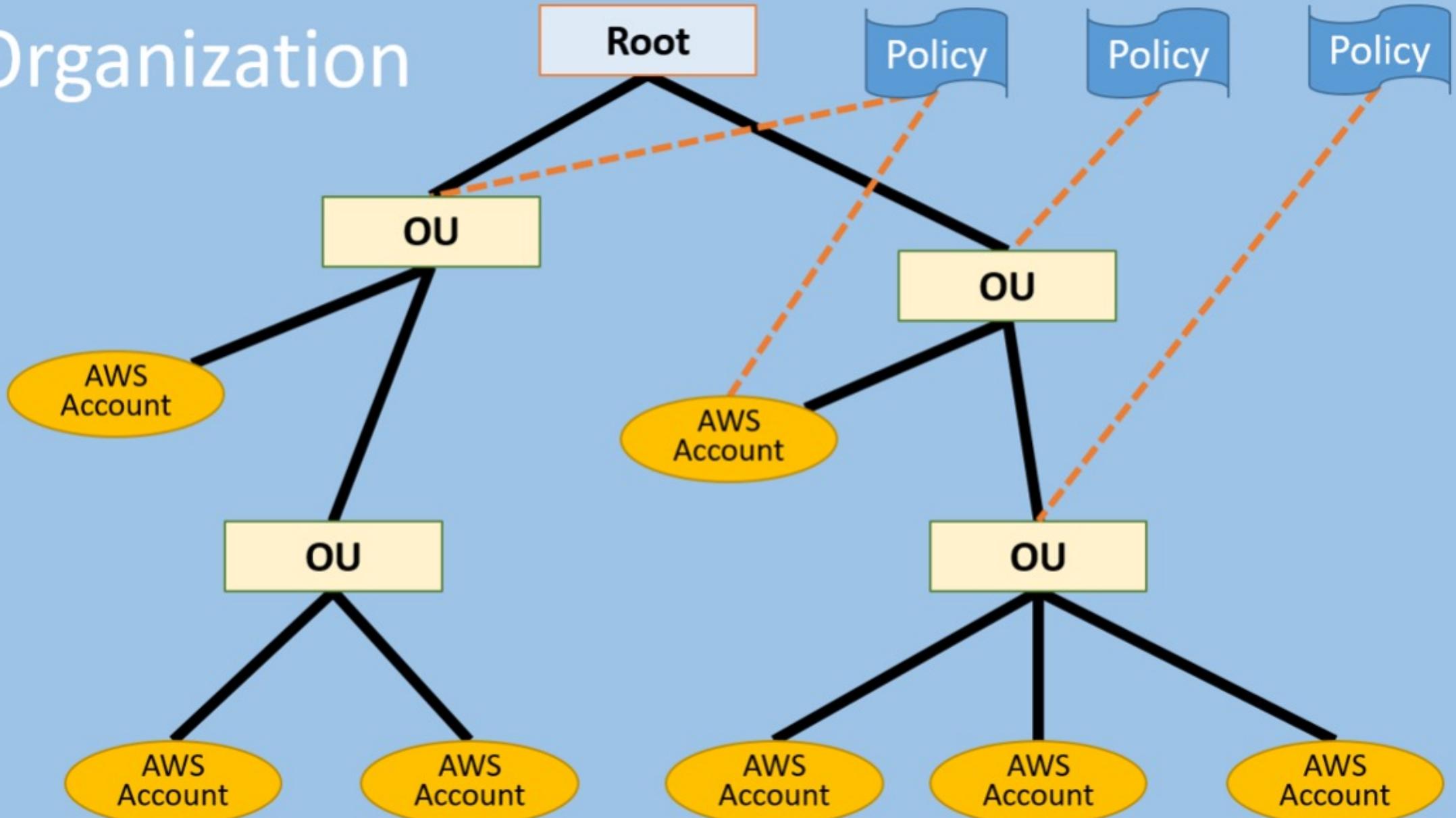
Organizations

- Collection of AWS accounts
- Centralized
 - One management interface
 - Billing
 - Account management
- No additional charge for use

Organizational Units (OUs)

- Hierarchical account management
- Nest OUs up to five levels deep
- Policies attached for permissions

Organization



- EPISODE 11.01
- AWS Lambda

Business Productivity

Desktop & App Streaming

Internet Of Things

AR / VR

Application Integration

Customer Engagement

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Security & Identity & Compliance

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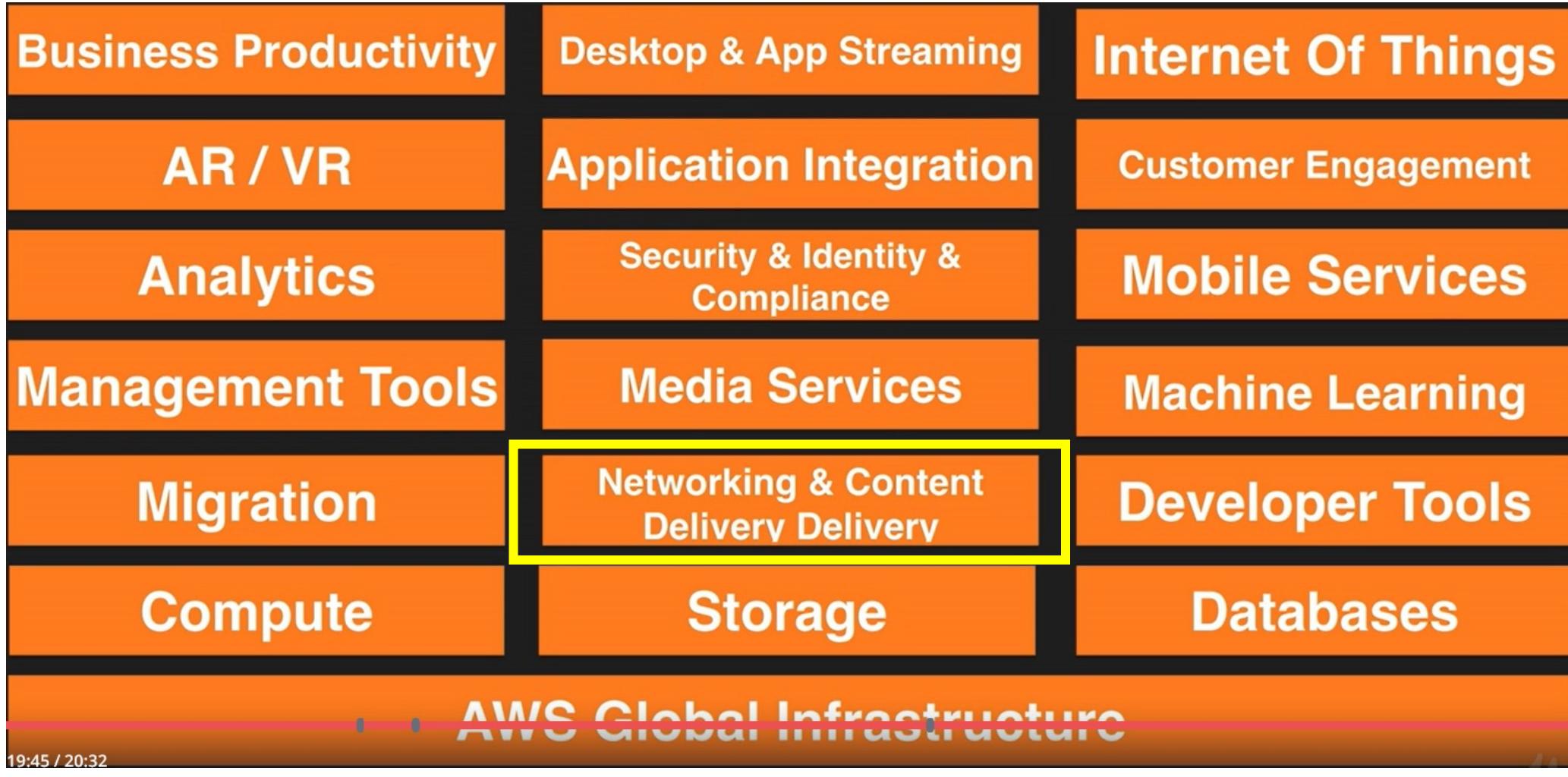
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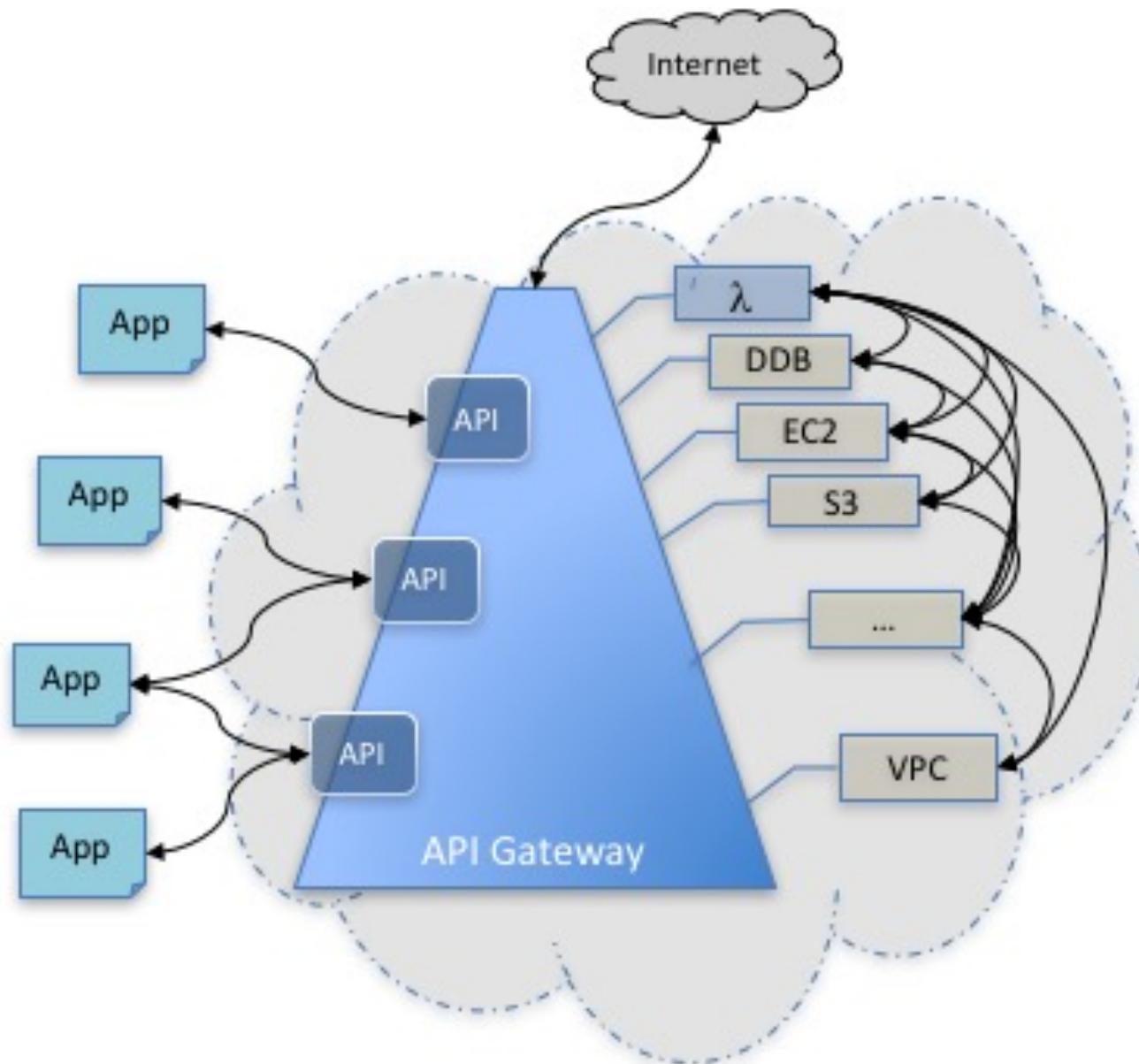
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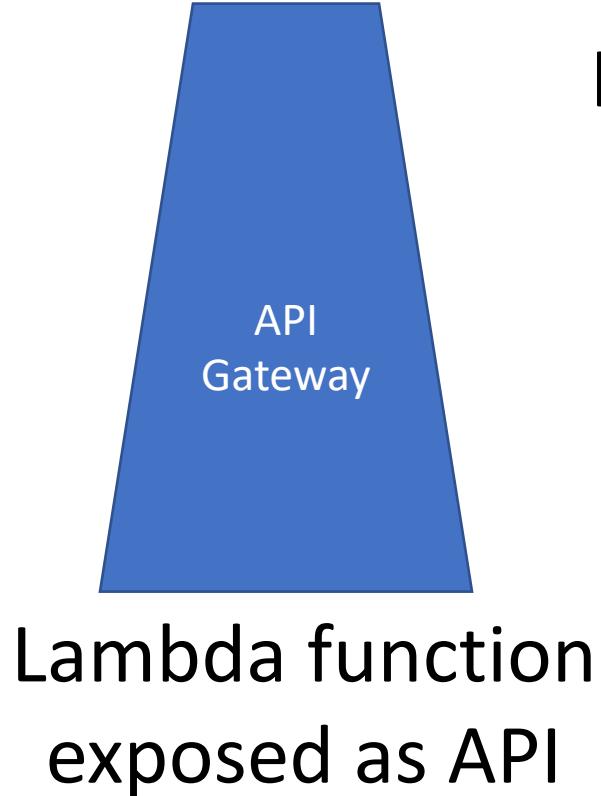
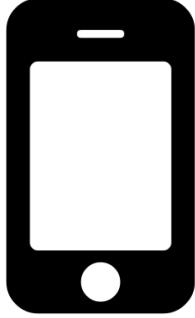


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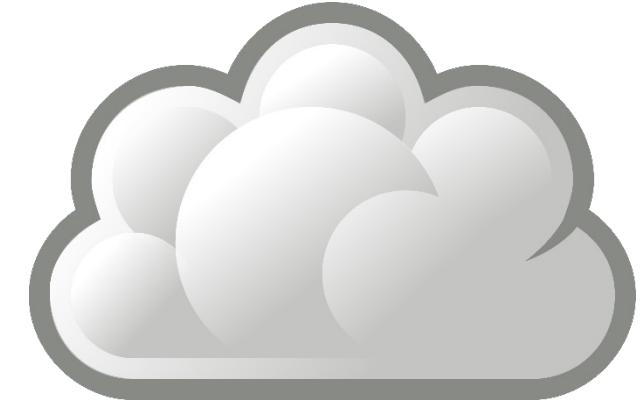
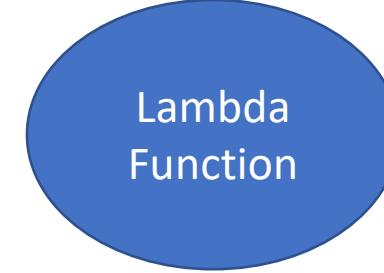
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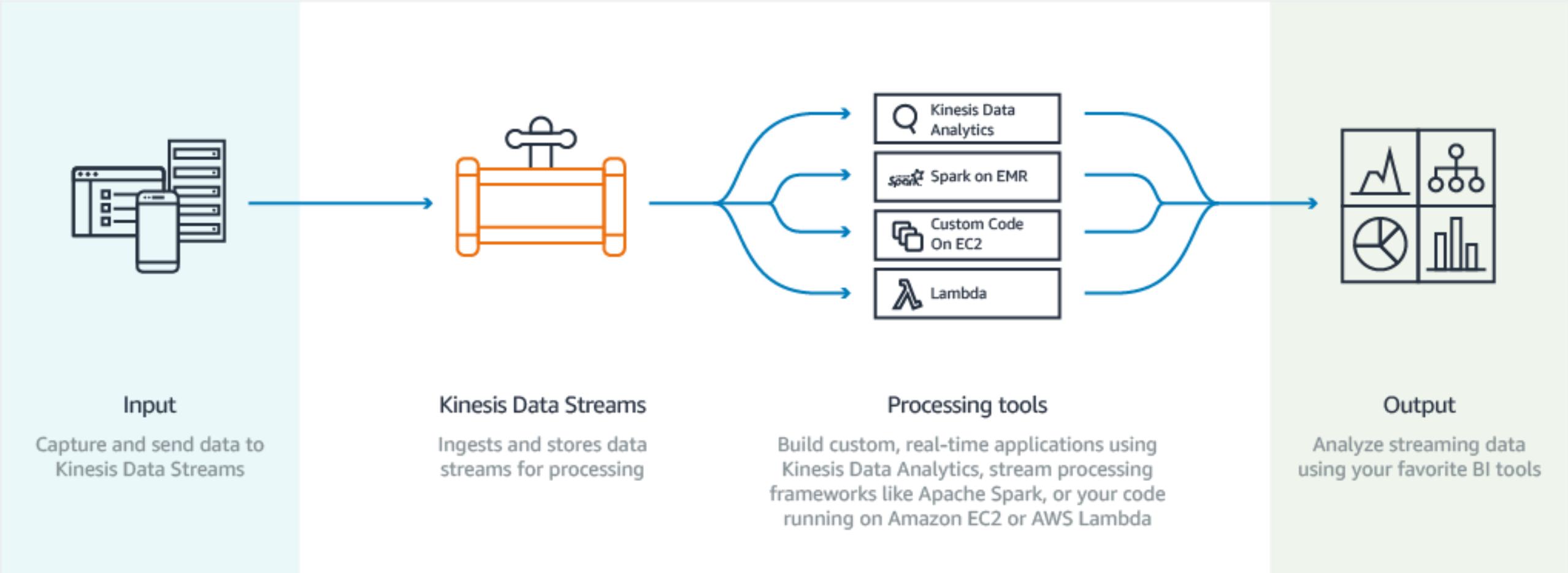
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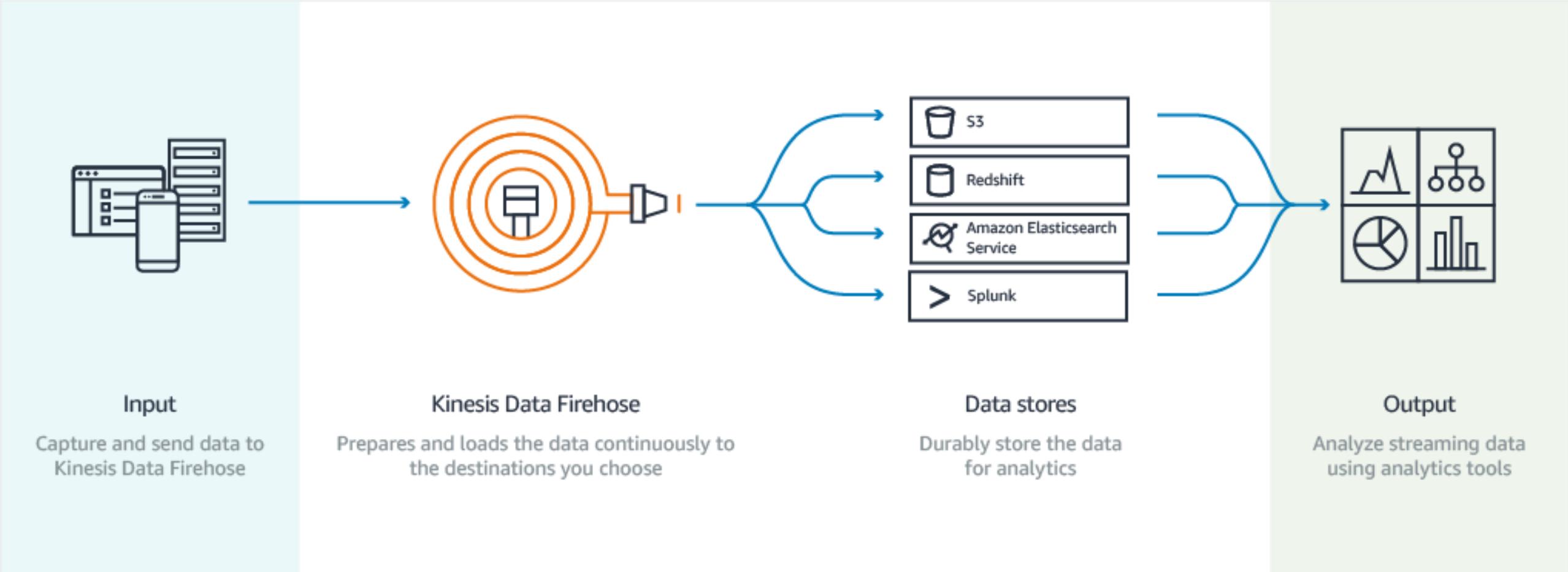
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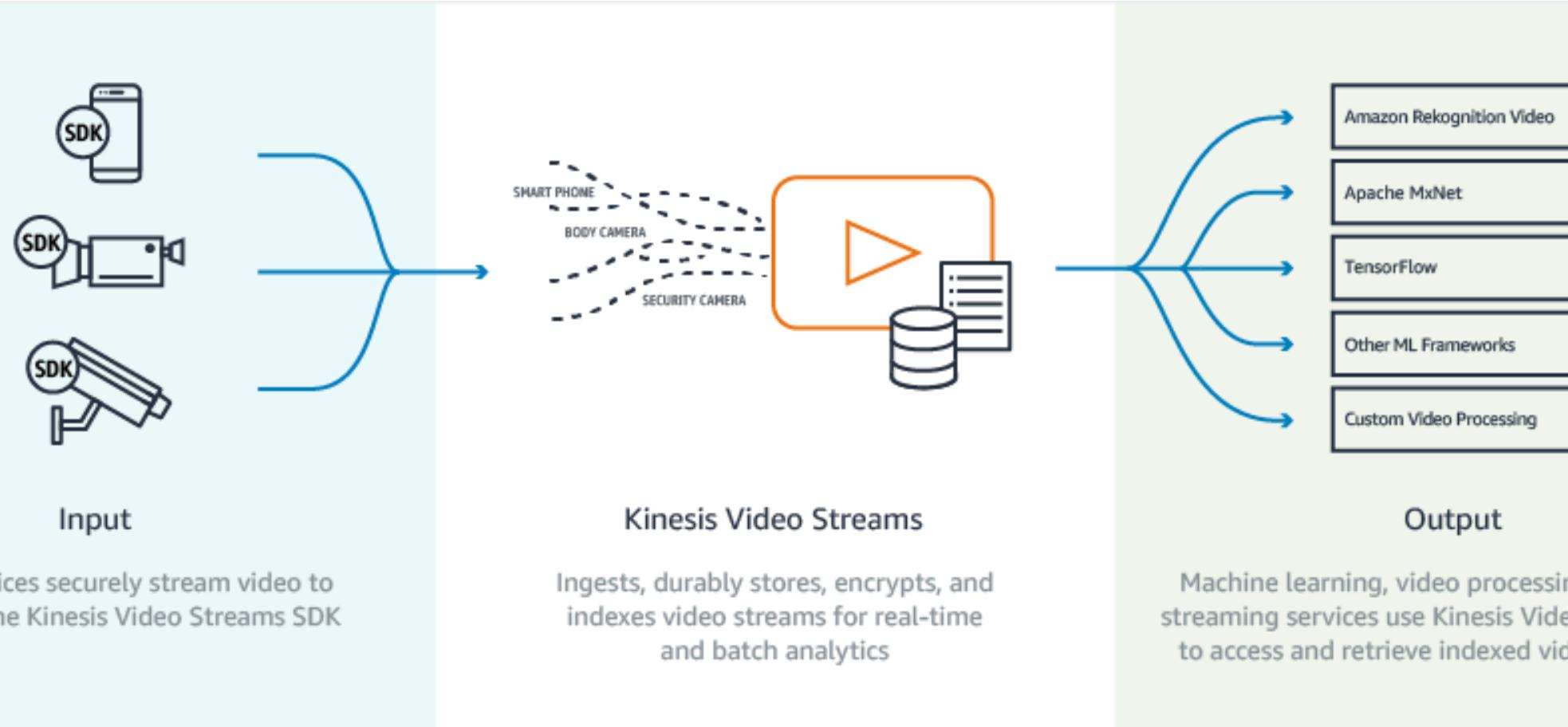
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Kinesis Data Firehose



Kinesis Video Streams



- EPISODE 11.06
- Kinesis Data Analytics

Kinesis Data Analytics

- Analyzes real-time data streams
- Based on standard SQL queries
- Supports concurrent consumers
 - Redshift
 - S3
 - Elasticsearch
 - Lambda
 - Kinesis Data Streams

Kinesis Data Analytics



Input

Capture streaming data
with Kinesis Data Firehose
or Kinesis Data Streams

Kinesis Data Analytics

Run standard SQL queries
against data streams

Output

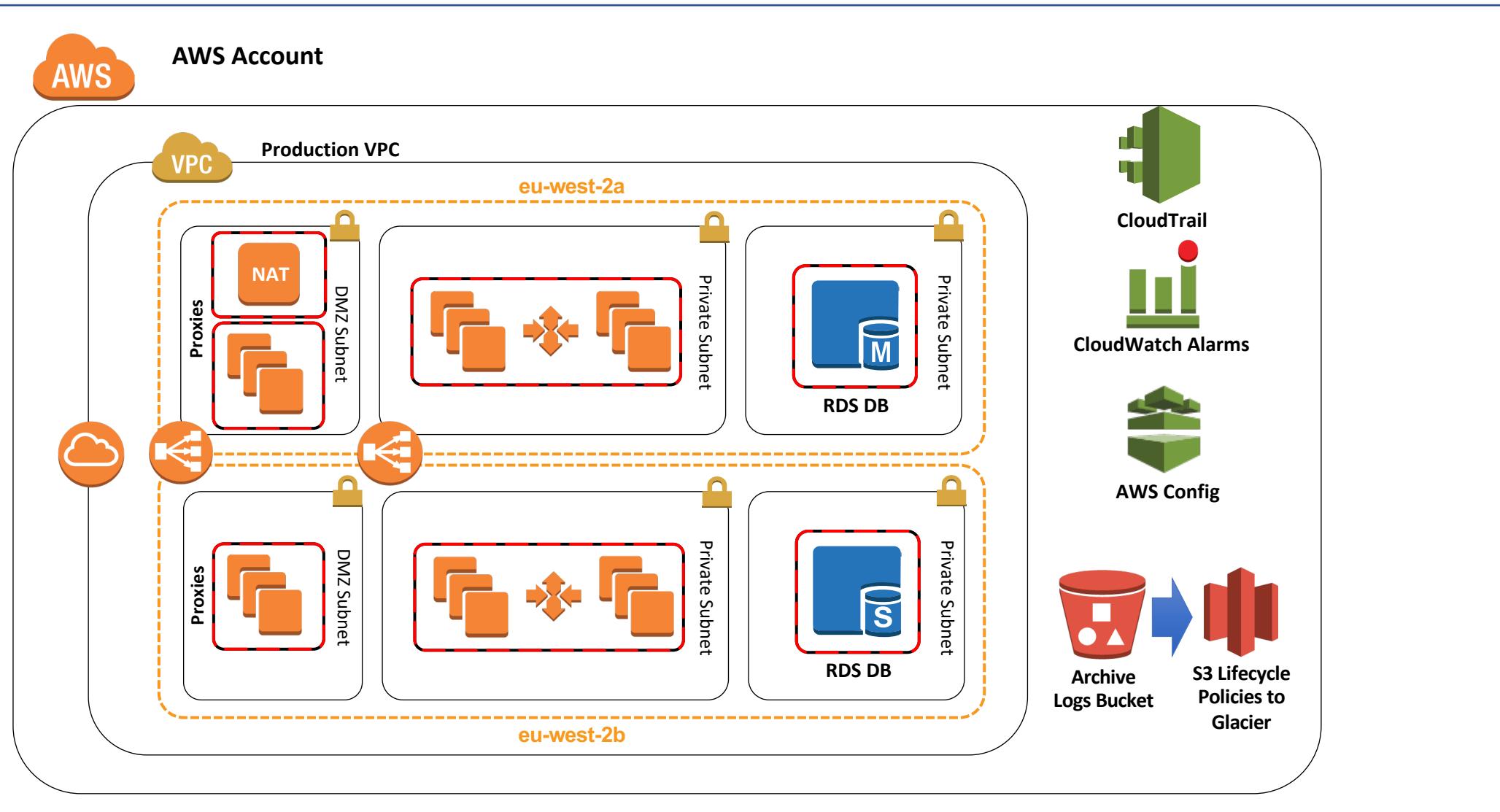
Kinesis Data Analytics can send
processed data to analytics tools so
you can create alerts and
respond in real-time

- EPISODE 11.07
- Reference Architectures

Reference Architectures

- Well-architected frameworks
- AWS created architecture plans for specific scenarios
 - HIPAA
 - PCI-DSS
 - UK-OFFICIAL

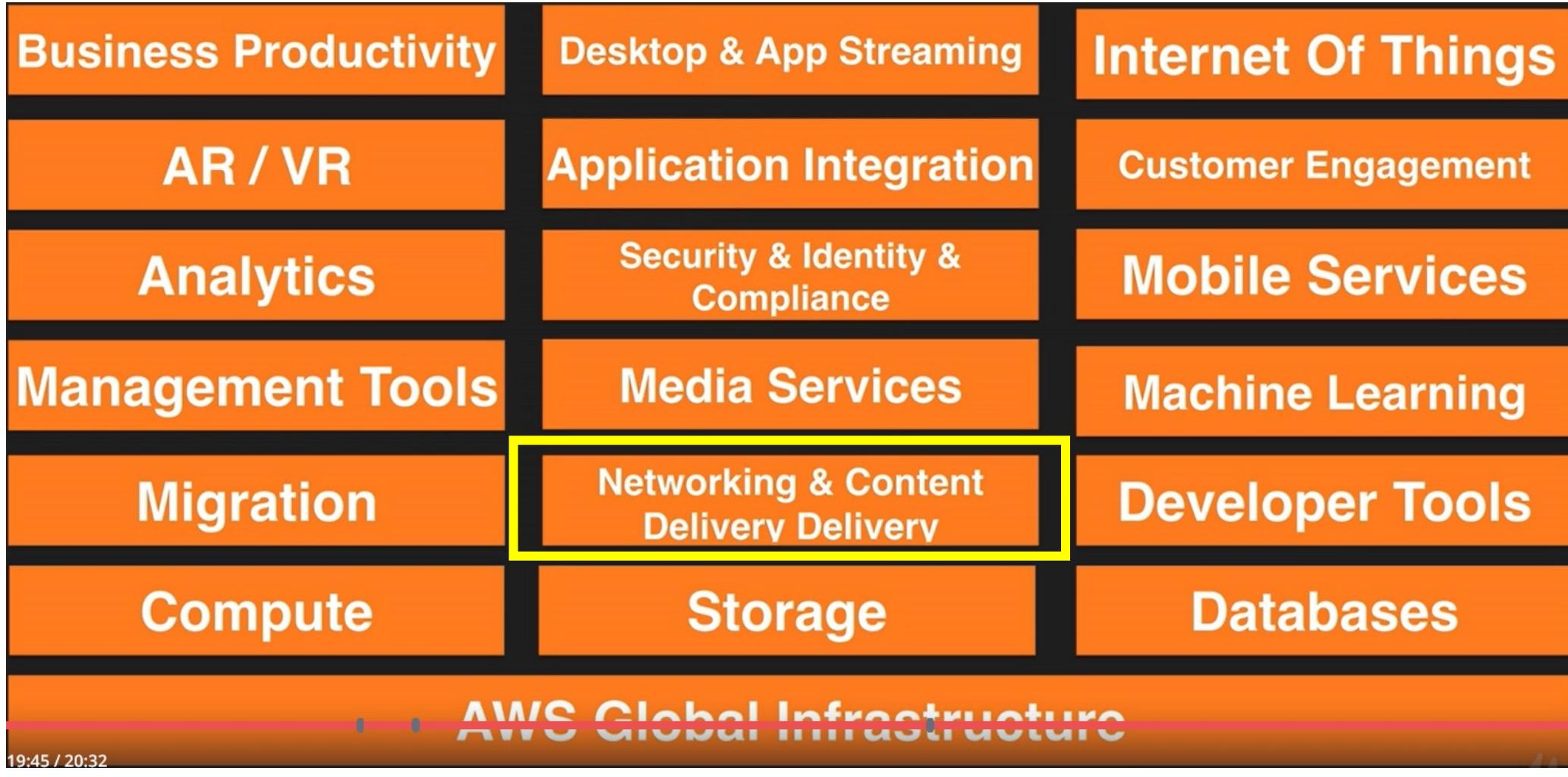
Reference Architecture



DEMO

- PCI-DSS Architecture
 - <https://docs.aws.amazon.com/qickstart/latest/compliance-pci/welcome.html>
- All the QuickStart Reference Architectures
 - <https://aws.amazon.com/quickstart/>

- EPISODE 11.08
- CloudFront

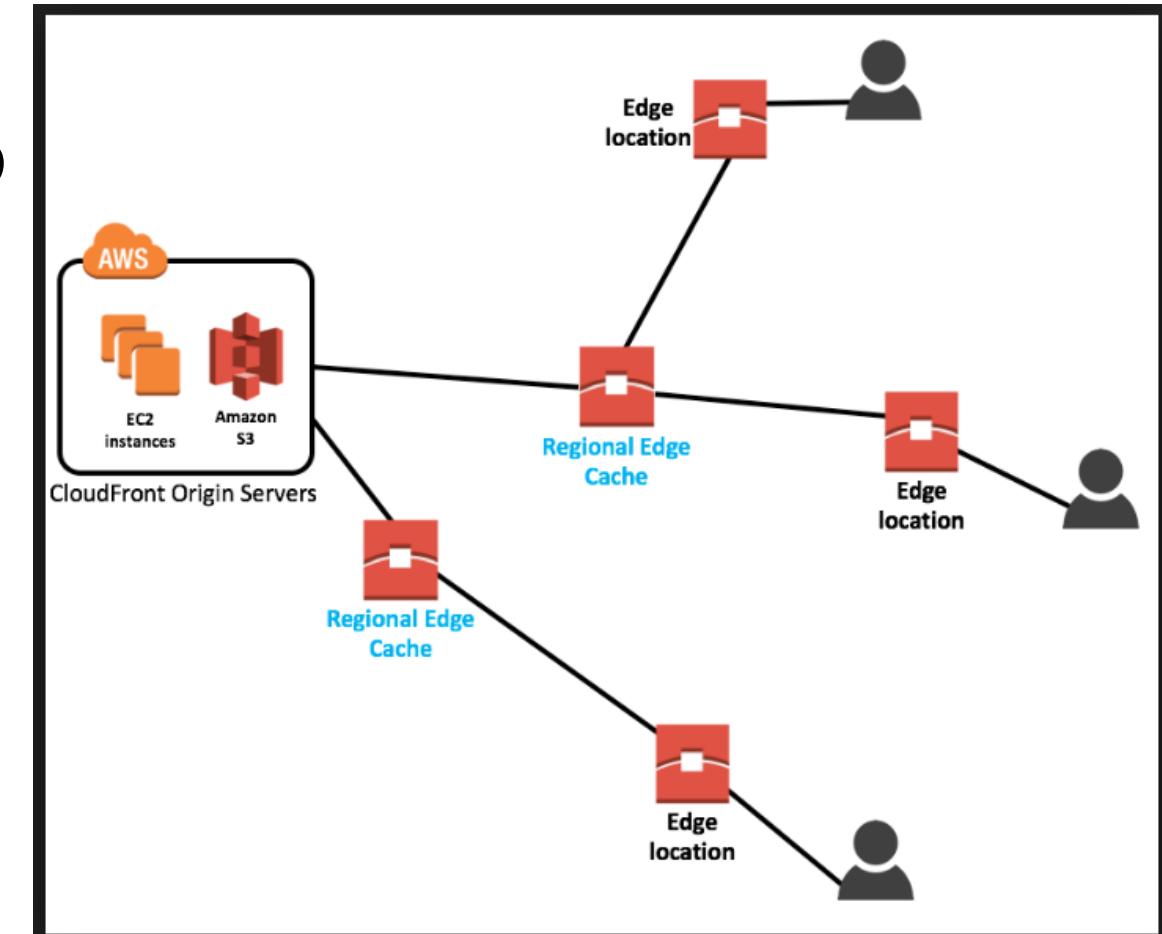


CloudFront

- Content delivery network (CDN)
 - Distributes content to localized regions
 - Reduces latency
 - Provides high data transfer speeds

CloudFront in Action

- Regional edge caches
- Edge locations



Demo

- Use Cases
- [https://docs.aws.amazon.c
om/AmazonCloudFront/lat
est/DeveloperGuide/Introd
uctionUseCases.html](https://docs.aws.amazon.com/AmazonCloudFront/latest/DeveloperGuide/IntroductionUseCases.html)

Implementation Considerations

- Content source
 - S3
 - MediaPackage channel
 - HTTP server

Implementation Considerations

- Content access
 - Public
 - Restricted
- Content constraints
 - HTTPS required
 - Geo-restrictions

- EPISODE 11.09
- Web Application Firewall

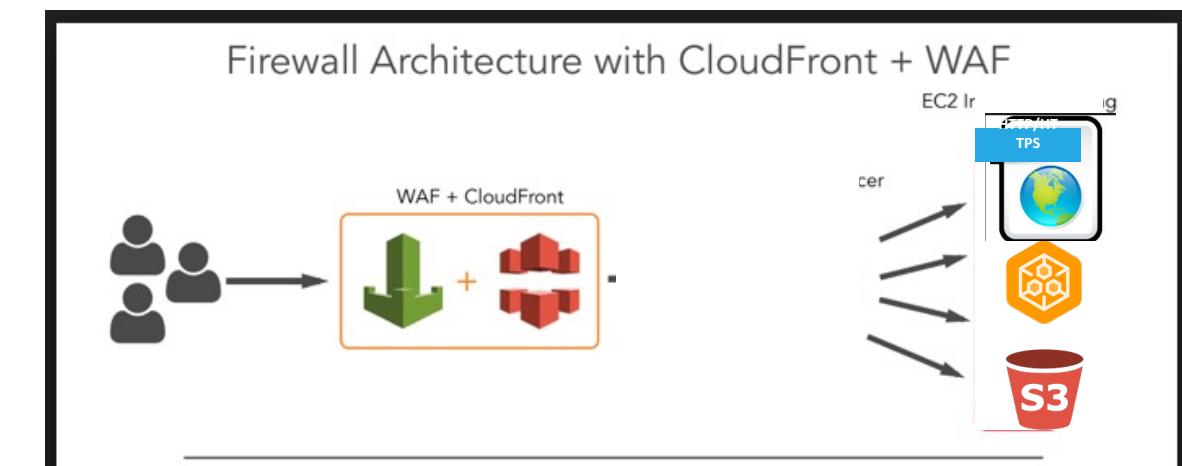
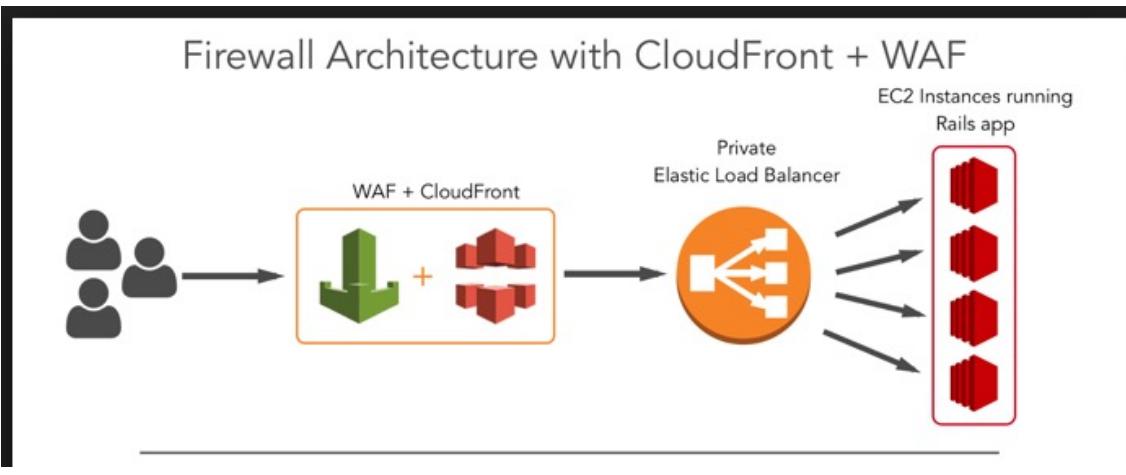
Business Productivity	Desktop & App Streaming	Internet Of Things
AR / VR	Application Integration	Customer Engagement
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Compute	Storage	Databases
AWS Global Infrastructure		

Web Application Firewall (WAF)

- Controls access to HTTP and HTTPS servers
 - Based on requests
 - Based on source IPs

Web Application Firewall (WAF)

- Works with CloudFront and/or Load Balancers



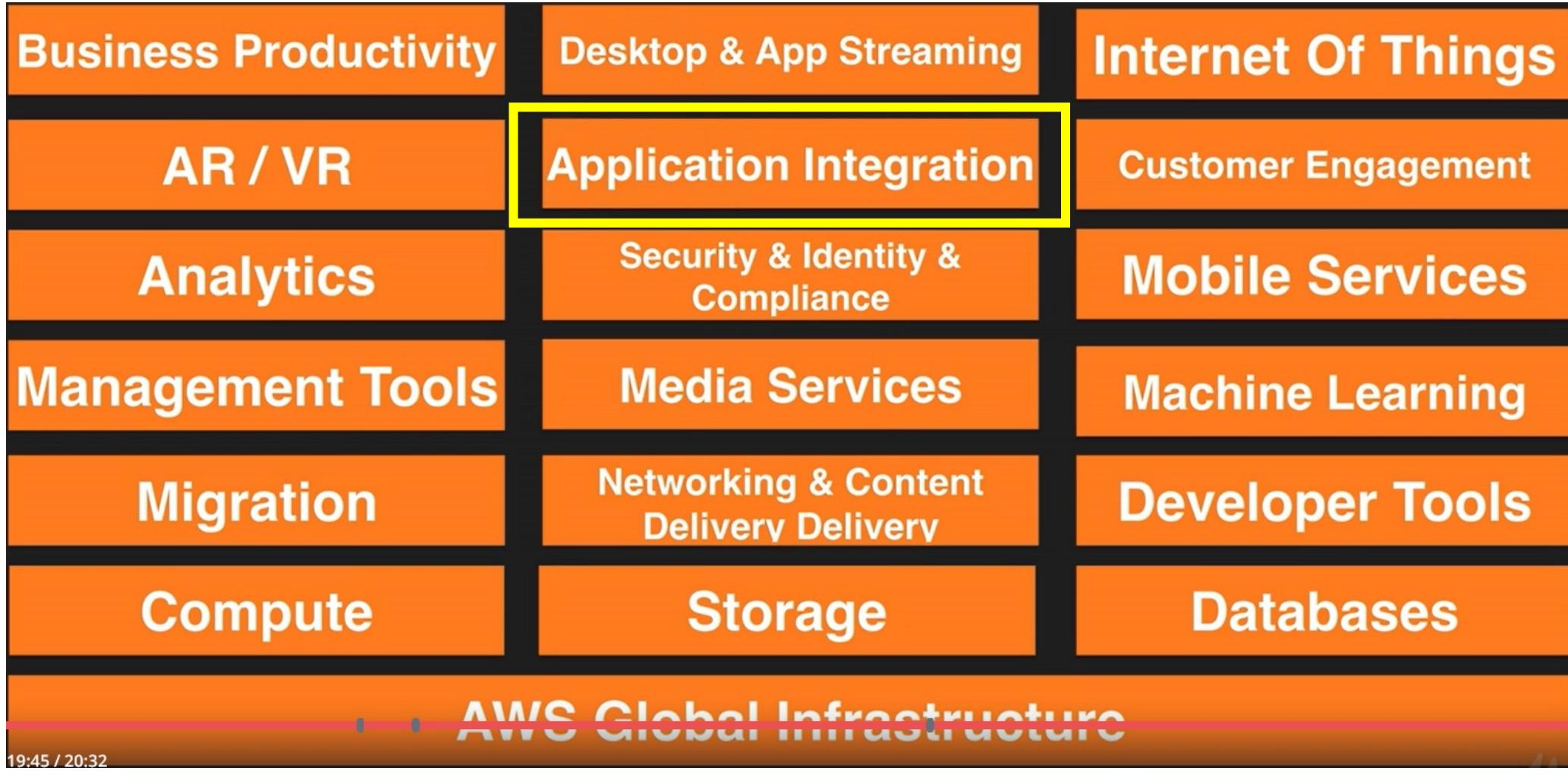
WAF Behaviors

- Allow all requests
 - Except the ones that you specify
- Block all requests
 - Except the ones that you specify
- Monitoring
 - Requests that match specified parameters

WAF Operations

- Error handling
 - HTTP 403 error (forbidden)
- Configurable default behavior
 - What happens when the request doesn't match any rules?
 - Allow
 - Deny

- EPISODE 11.10
- Simple Queue Service
(SQS)



Simple Queue Service (SQS)

- Used to decouple applications
 - Break application into separate processing tasks
 - Allows many small processes to form a complete solution

SQS Messages

- Outputs from other processes
- Inputs to other processes
- Queued and processed asynchronously
 - Non-linear
- Up to 256 KB data
 - Record pointers, directives, parameters

SQS Participants

- Message producers
- Message consumers
- Messaging service
 - SQS

SQS Features

- Redundant across multiple AZs
 - Queued until processed
 - Retention up to 14 days
- Automatically scales

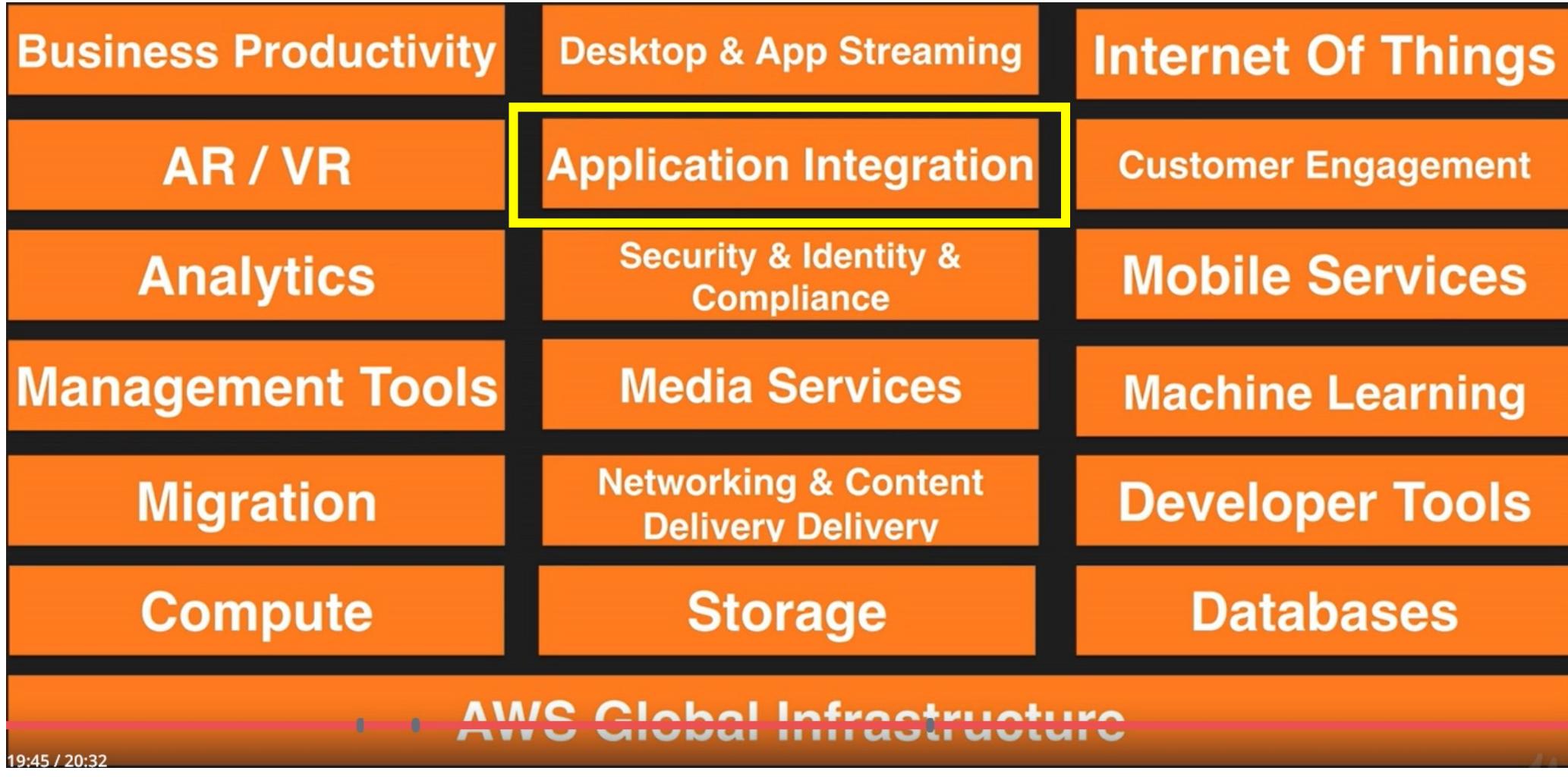
SQS Queue Types

- Standard
 - Default queue type
 - Doesn't guarantee sequential delivery of messages

SQS Queue Types

- First-In-First-Out (FIFO)
 - Guarantees sequential delivery of messages
 - Supports fewer transactions per second

- EPISODE 11.10
- Simple Notification Service (SNS)



Simple Notification Service (SNS)

- Paging in the cloud
- Uses the publish-subscribe mechanism based on “topics”
 - Called pub-sub messaging

Publishers

- Publishers push messages to topics
 - Topic examples:
 - Admin alerts, performance alerts, etc.
 - Publisher examples:
 - CloudWatch, Cost Explorer, etc

Subscribers

- Clients receiving notifications
- Receive all messages broadcasted to the topic
- Publishers and subscribers aren't “aware” of each other

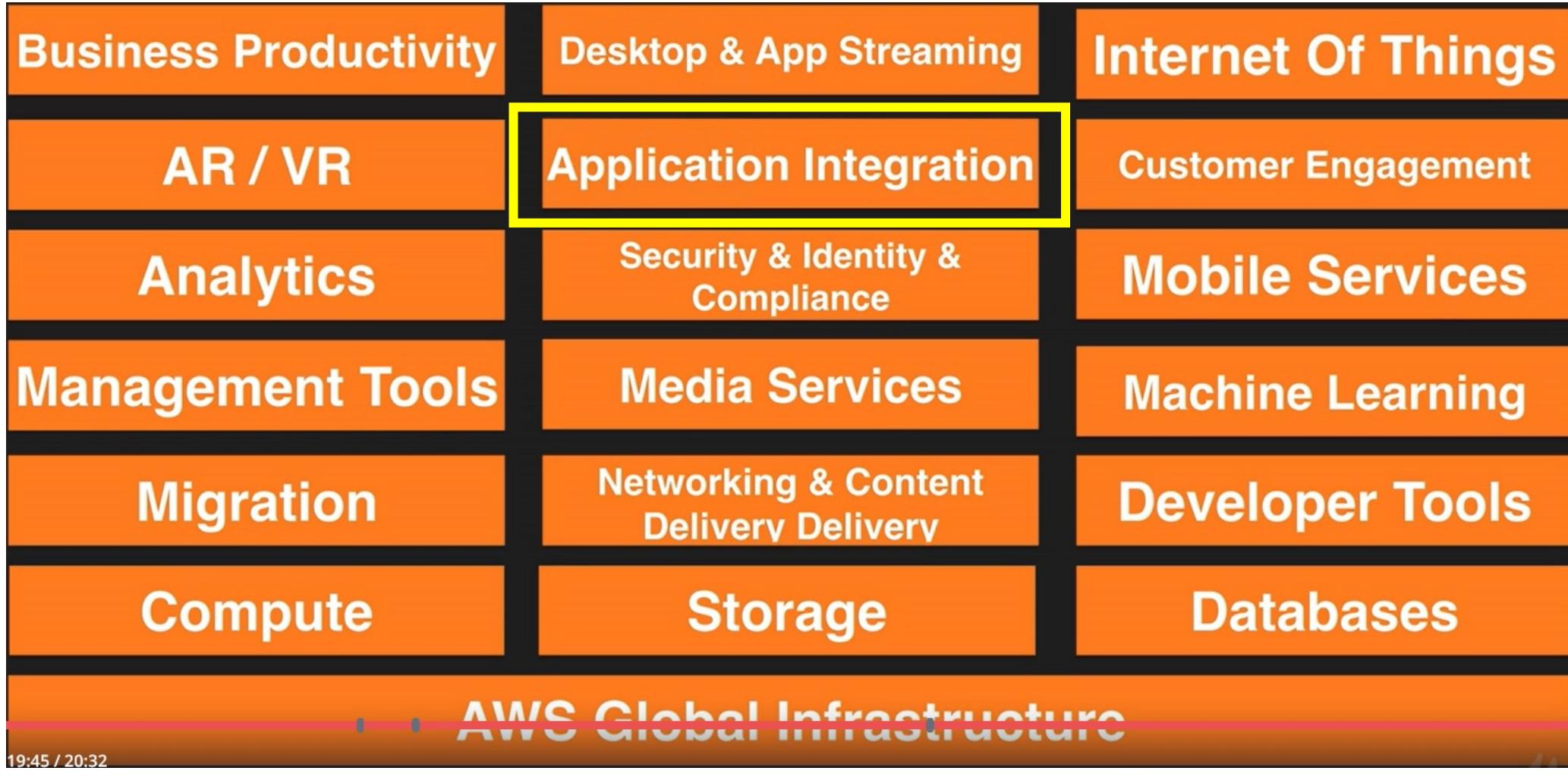
SNS Features

- Stored across multiple AZs
- Several delivery options supported
 - HTTP/HTTPS
 - E-Mail
 - SMS (Short Message Service)
 - Lambda
 - SQS

SNS Message Limits

- Up to 256 KB of data
- Special SMS constraints:
 - Max size of single SMS is 140 bytes
 - Larger messages sent as multiple transmissions
 - Aggregate SMS size is 1600 bytes

- EPISODE 11.11
- Simple Workflow (SWF)



Simple Workflow (SWF)

- Defines the sequence of events required to achieve a workflow
- Used in decoupled applications

Workflow

- Activities that result in a desired objective
- Logic that controls the activities
 - Decider function determines best workflow
- Operates in a domain
 - Created logical boundary in SWF to constrain the scope of the activities

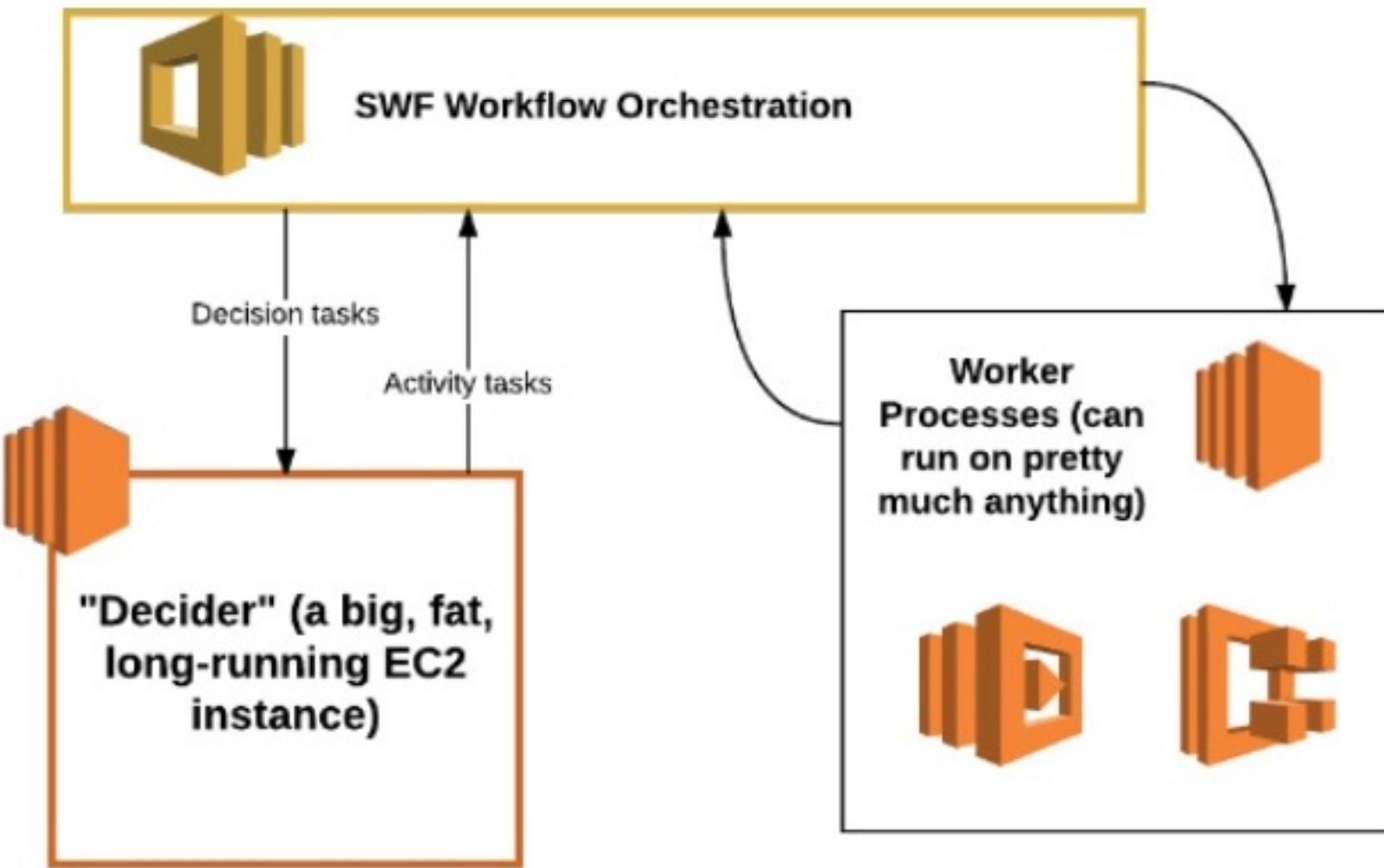
SWF Activity Tasks

- One invocation of an activity
 - For example, processing an order
- May be invoked multiple times
 - For example, processing a multi-item order

SWF Activity Workers

- The application that receives and processes activity tasks

TRADITIONAL SWF ARCHITECTURE



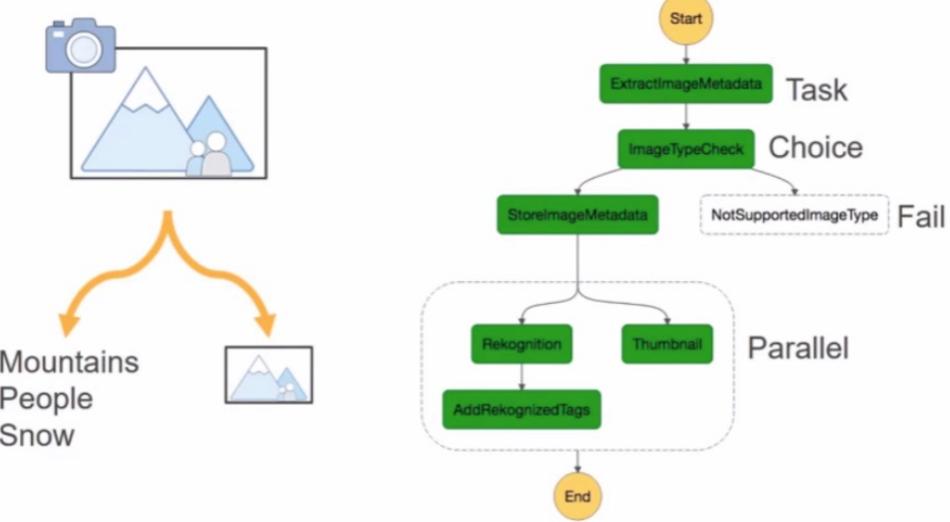
- EPISODE 11.12
- Step Functions

Step Functions

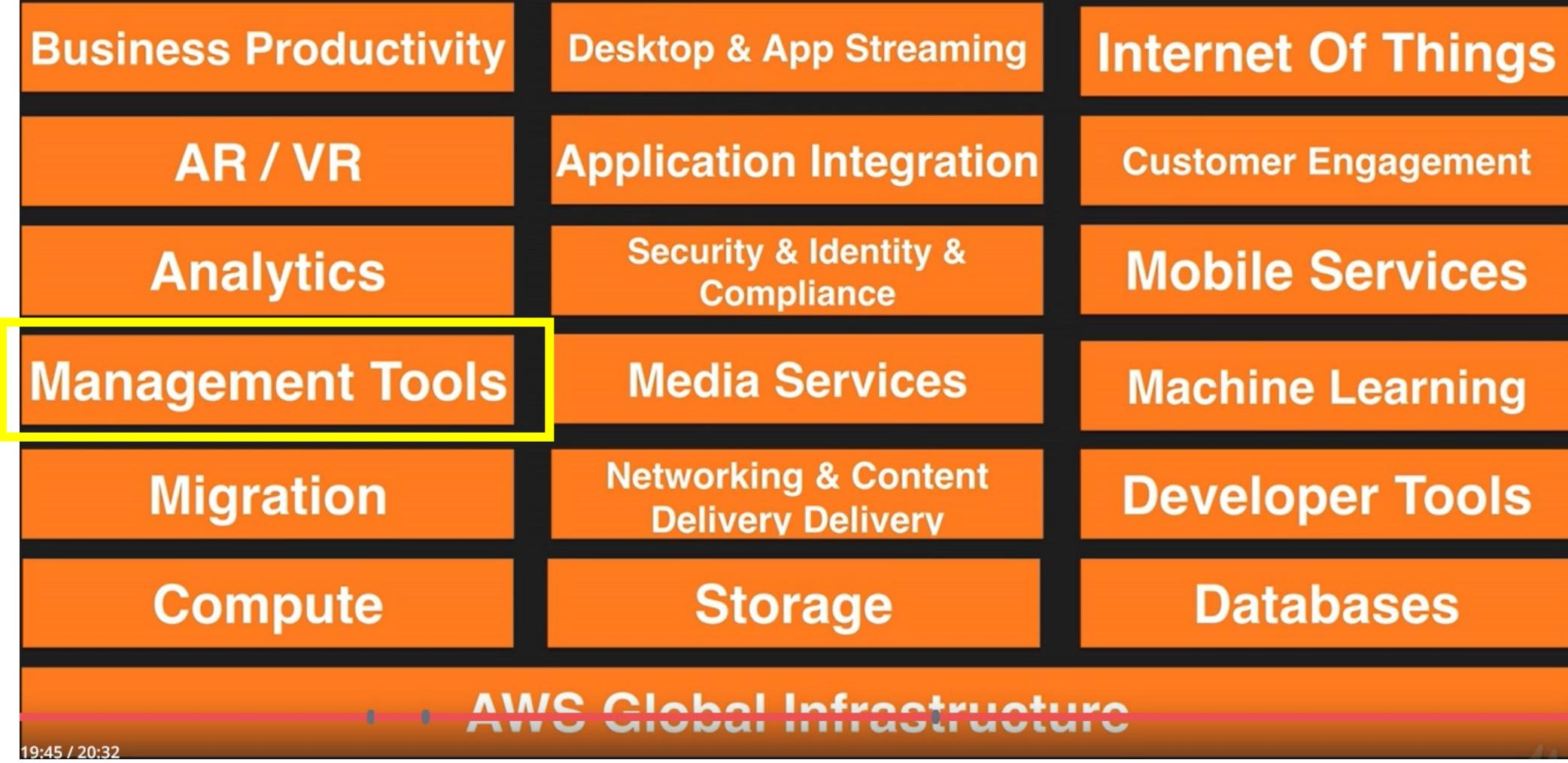
- AWS recommended practice
 - Eventually replacing SWF
- Similar to SWF in functionality
 - Uses state machines
 - Decider
 - Activity tasks
 - Worker tasks

Step Function Concepts

- Task
 - Single unit of work
- Choice
 - Provides branching logic
- Parallel
 - Process input through multiple tasks and combine the output



- EPISODE 11.13
- OpsWorks



OpsWorks

- Configuration management service
 - Configure (code-based)
 - Instance deployment
 - Service deployment
 - Application deployment
 - Operate
 - Application updates
 - Infrastructure updates
- Automated deployment

OpsWorks Stacks

- Initial OpsWorks mode
- Collection of layers
 - Any AWS service
 - Any runtime environment

OpsWorks Chef Automate

- Cookbooks contain recipes
- Recipes equivalent to layers
 - Defined configuration settings
 - Admin defined
 - AWS defined
 - Third-party defined

OpsWorks Puppet

- Master servers
 - Pre-configured modules
 - Modules equivalent to layers

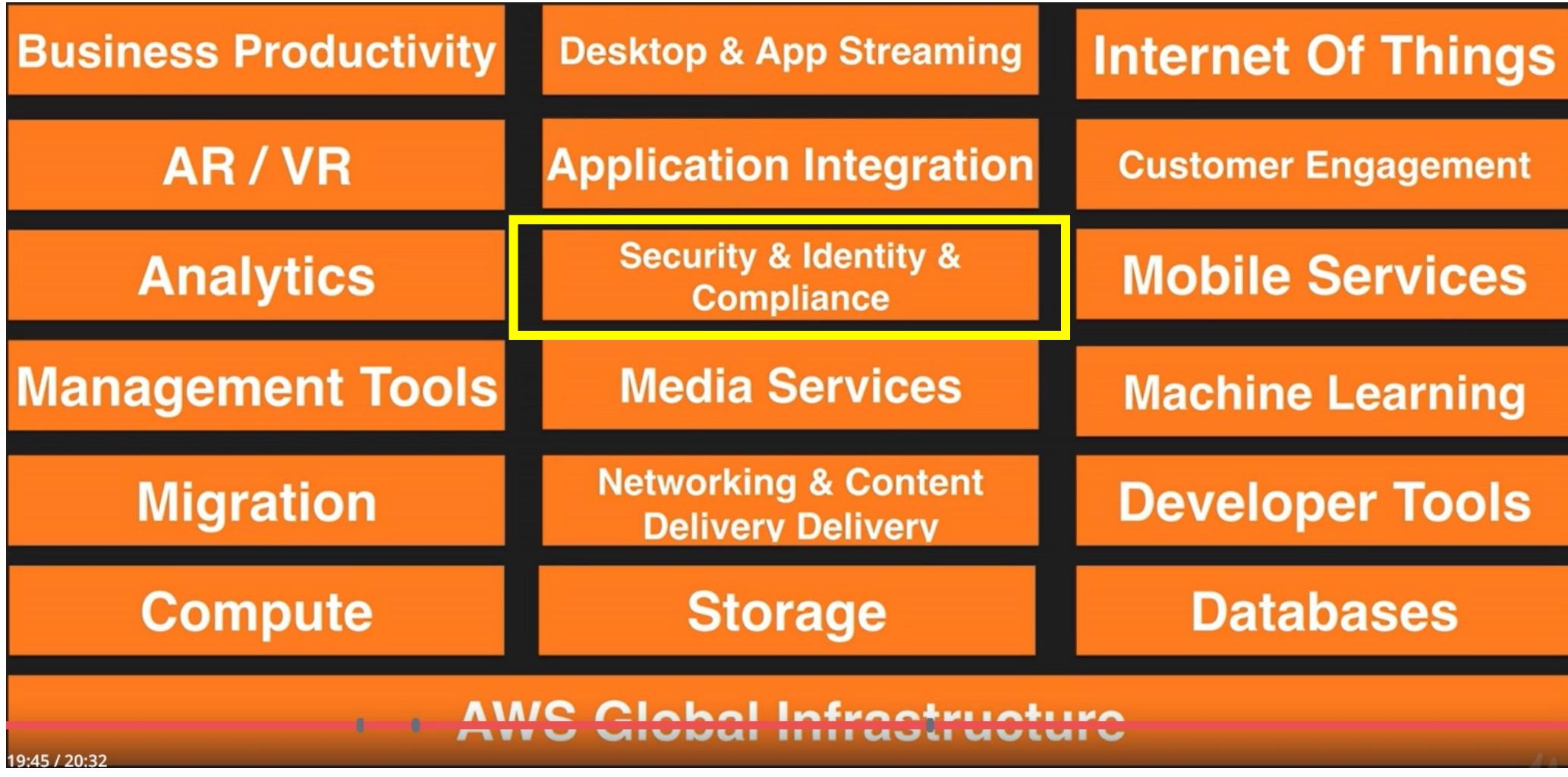
Prebuilt Layers

- Ruby
- PHP
- Node.js
- Java
- Amazon RDS
- HA Proxy
- MySQL

Use Cases

- In the cloud:
 - Chef
 - Puppet
- On-premises (local):
 - Stacks

- EPISODE 11.
- Cognito



Cognito

- User identity and data synchronization service
 - SSO
- Public identity providers
 - Google
 - Facebook
 - Amazon
- Private identity providers
 - Active Directory with SAML

Identity Management

- Based on open standards
 - OAuth 2.0
 - SAML 2.0
 - OpenID connect
- Profile management
- Scales to millions of users

AWS Integration

- Cognito controls access to AWS resources
 - Define roles
 - Map users to roles

- EPISODE 11.14
- Elastic MapReduce (EMR)

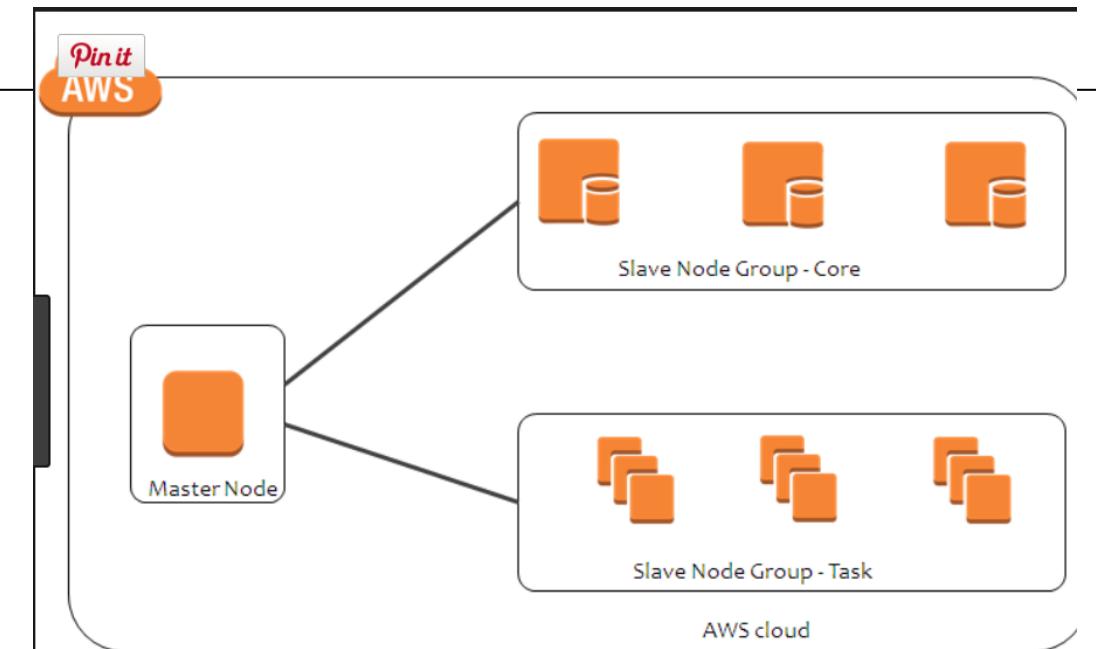
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Elastic MapReduce (EMR)

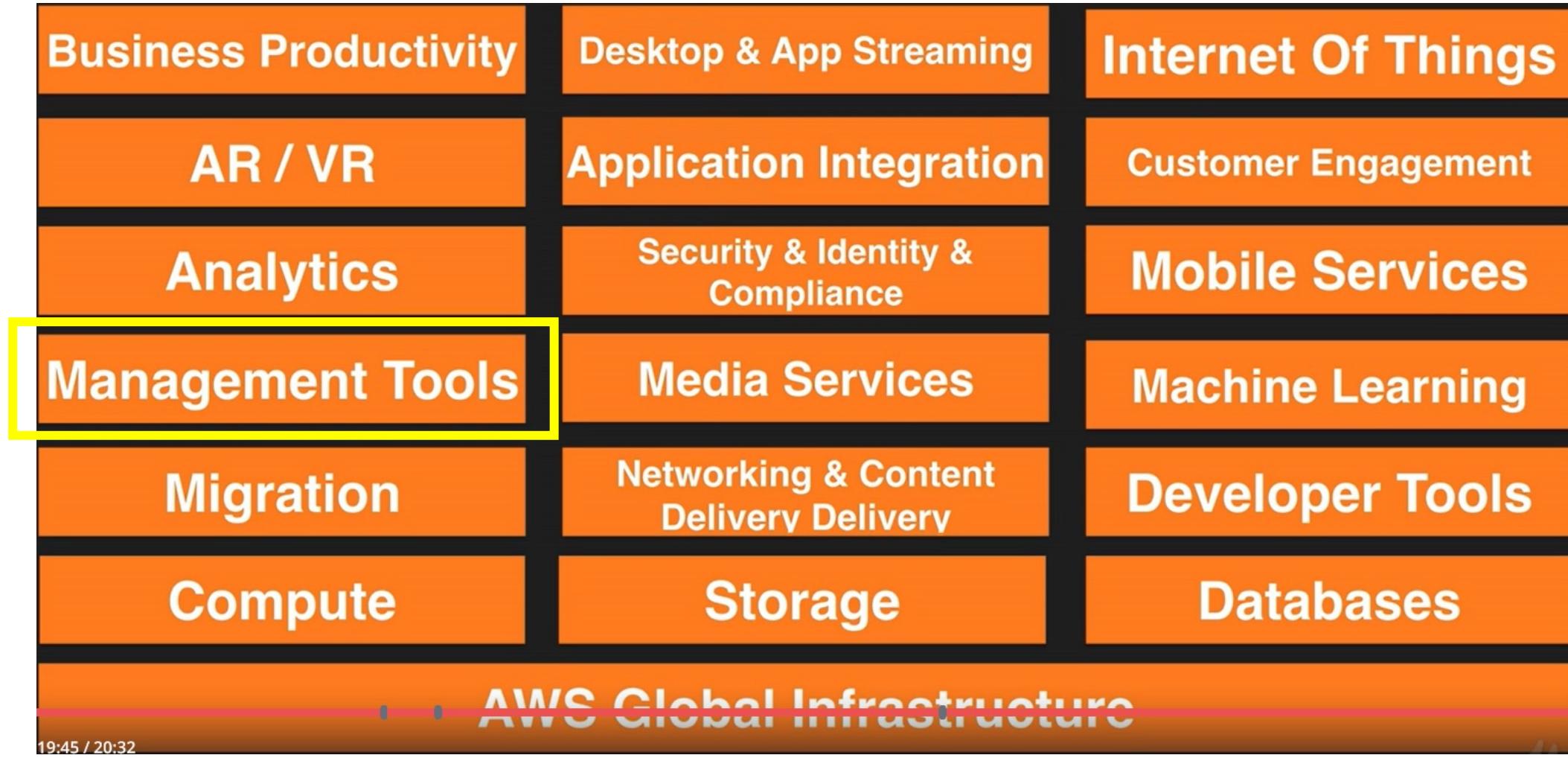
- Distributes processing across clusters
 - Implements a managed Hadoop framework
- Pulls data from S3 buckets
- Uses EC2 instances
- User defines the number of needed clusters

EMR Cluster Nodes

- Master
 - Coordinates job distribution across core and task nodes
- Core
 - Runs tasks assigned by the master node
 - Stores data in the cluster
- Task
 - Runs only tasks that do not store data



- EPISODE 11.15
- CloudFormation



CloudFormation

- Graphical interface
- Uses templates to build entire solutions in AWS
 - EC2 instances
 - Security groups
 - Subnets
 - IAM users and roles
 - Etc.

CloudFormation

- Components:
 - Templates
 - Build the stacks
 - Stacks
 - Implementation of templates
 - Change sets
 - Modify stacks

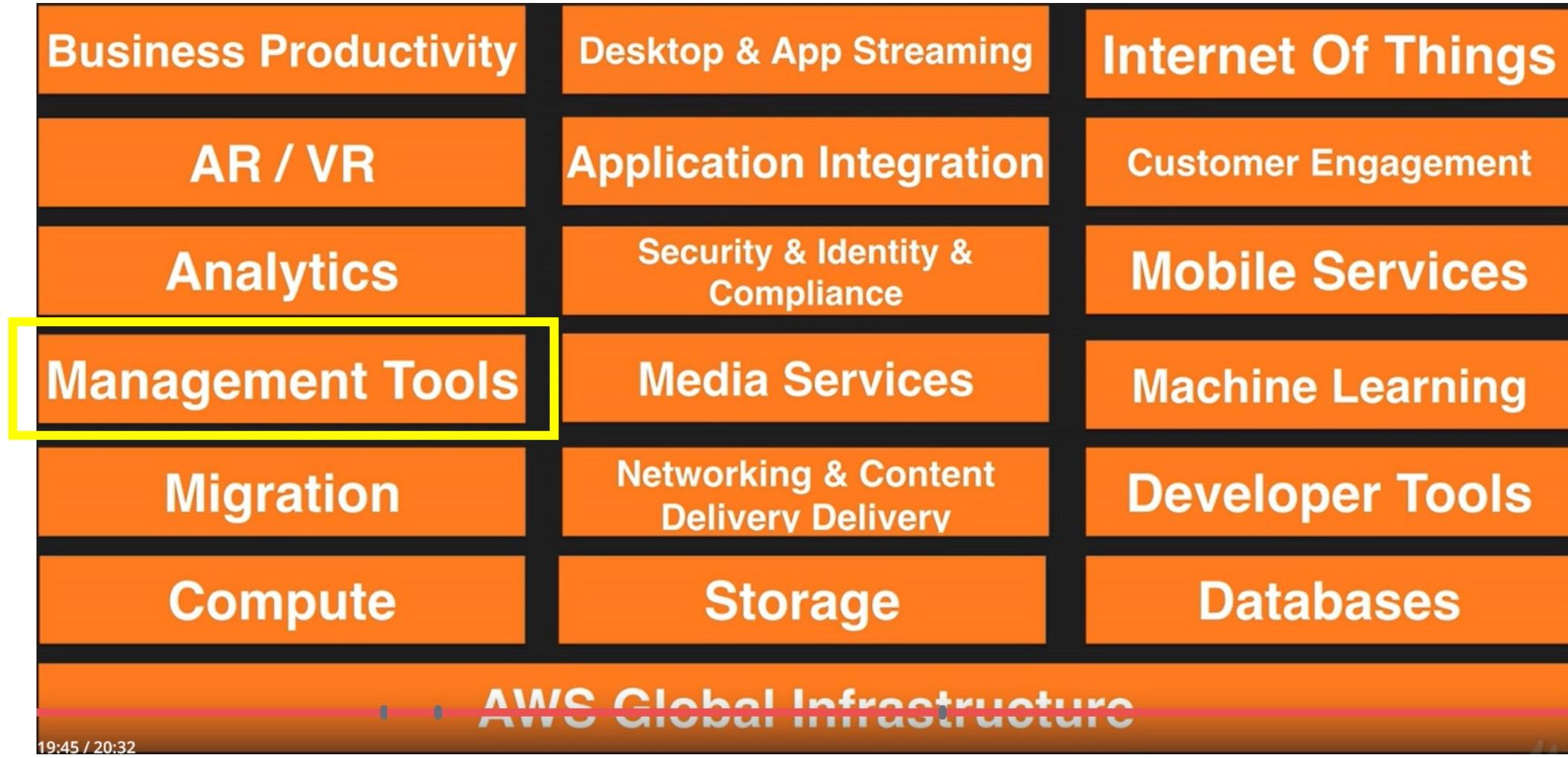
CloudFormation

- Why use it?
 - Rapid deployment
 - Mirror existing internal architectures
 - Take advantage of templates created by others

DEMO

- CloudFormation

- EPISODE 11.16
- CloudWatch



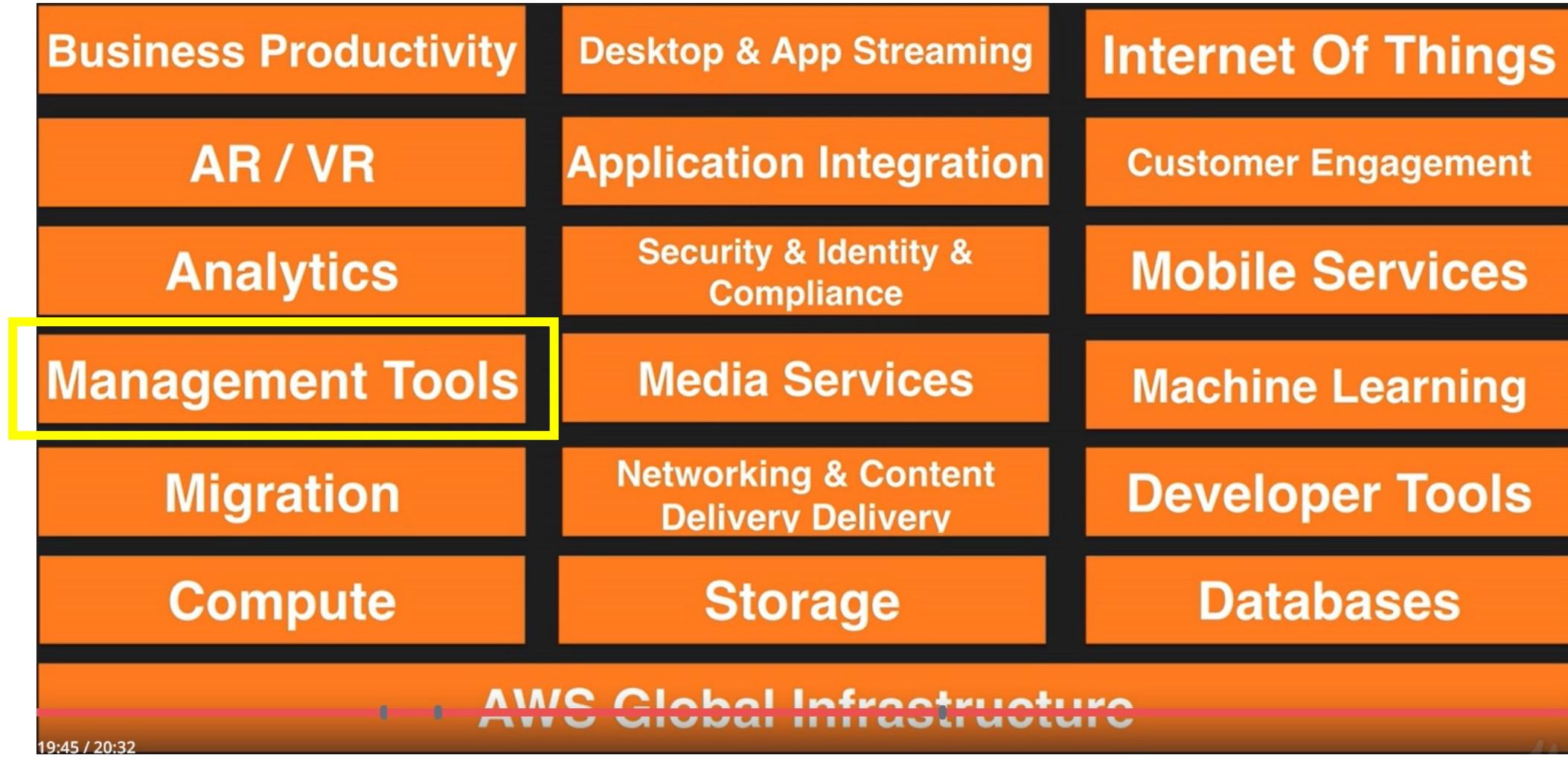
CloudWatch

- Monitors the cloud and on-premises systems
- Dashboards
- Logs
- Events
- Alarms

CloudWatch

- Why use it?
 - Monitor critical systems
 - Receive notifications related to performance and security
 - Push on-premises logs into the cloud
 - Take automatic actions based on alarms

- EPISODE 11.17
- AWS Trusted Advisor



Trusted Advisor

- Recommendations for security and other issues
- Scans the AWS cloud for recommendations

DEMO

- The Trusted Advisor interface

- EPISODE 11.18
- AWS Organizations

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AWS Global Infrastructure		

Organizations

- Collection of AWS accounts
- Centralized
 - One management interface
 - Billing
 - Account management
- No additional charge for use

Organizational Units (OUs)

- Hierarchical account management
- Nest OUs up to five levels deep
- Policies attached for permissions