Amazon EMR Immersion Day

Agenda

7:00 AM – 7:15 AM. Welcome and Introductions

7:15 AM - 8:00 AM. Introduction to Amazon EMR

8:00 AM – 8:15 AM. Break / Q &A

8:15 AM – 8:45 AM. EMR Cluster Creation Overview

8:45 AM – 9:15 AM. Lab – EMR Cluster Creation

9:15 AM – 9:30 AM. Break / Q &A

9:30 AM – 10:00 AM. Lab – Hive, Pig, & EMR

10:00 PM – 11:00 AM. Lunch Break

11:00 AM – 11:45 AM. Amazon EMR Well-Architected and Best Practices

11:45 AM – 12:00 PM. Break / Q &A

12:00 PM – 12:45 PM. Lab – Spark-based ETL and Notebooks on EMR

12:45 PM – 1:00 PM. Close Out and Next Steps

To participate in the labs, please send an email to **dbayard@amazon.com**

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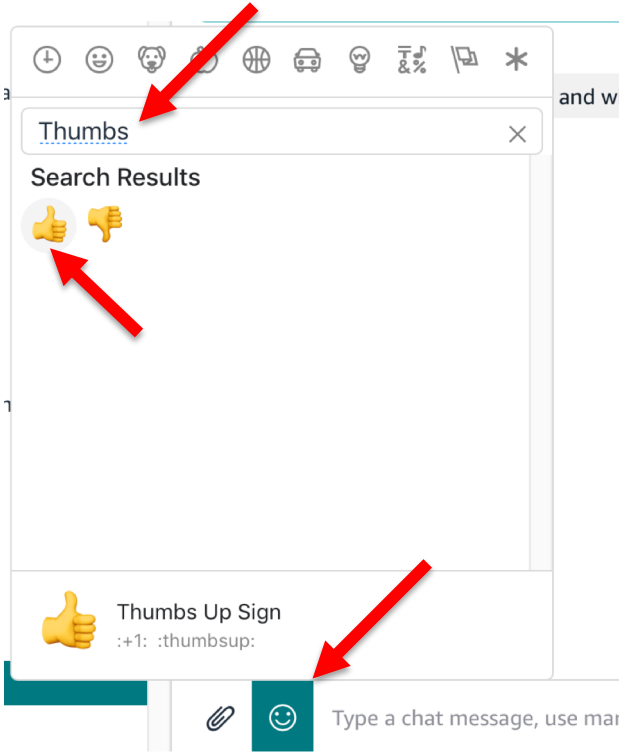
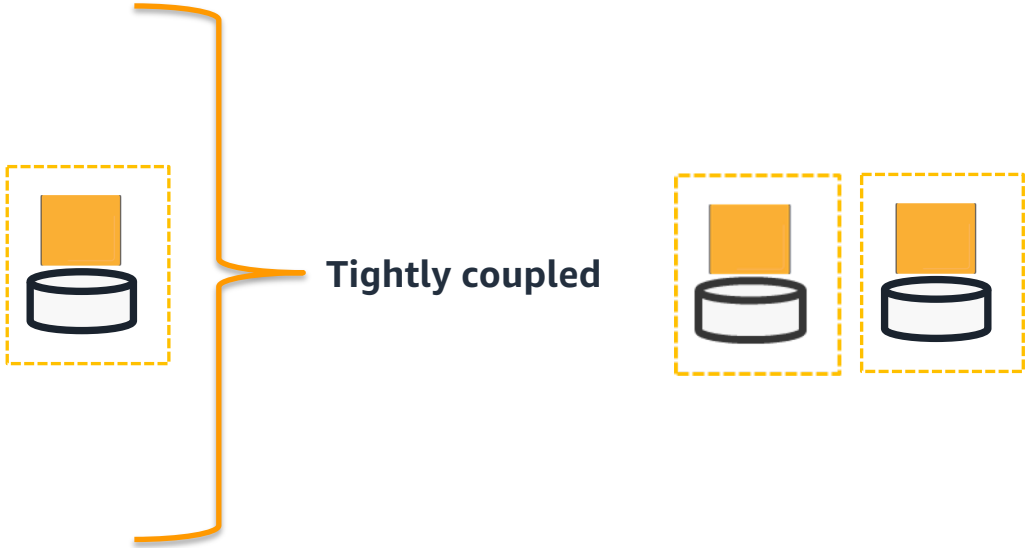
Level-set: Raise your hand if know these acronyms/terms?

- HDFS?
- Hive?
- Spark?
- Jupyter?
- EC2?
- S3?
- EMR?



The Need for Change.
Challenges of on-premises clusters.

Compute and storage grow together



- Storage grows along with compute
- Compute requirements vary

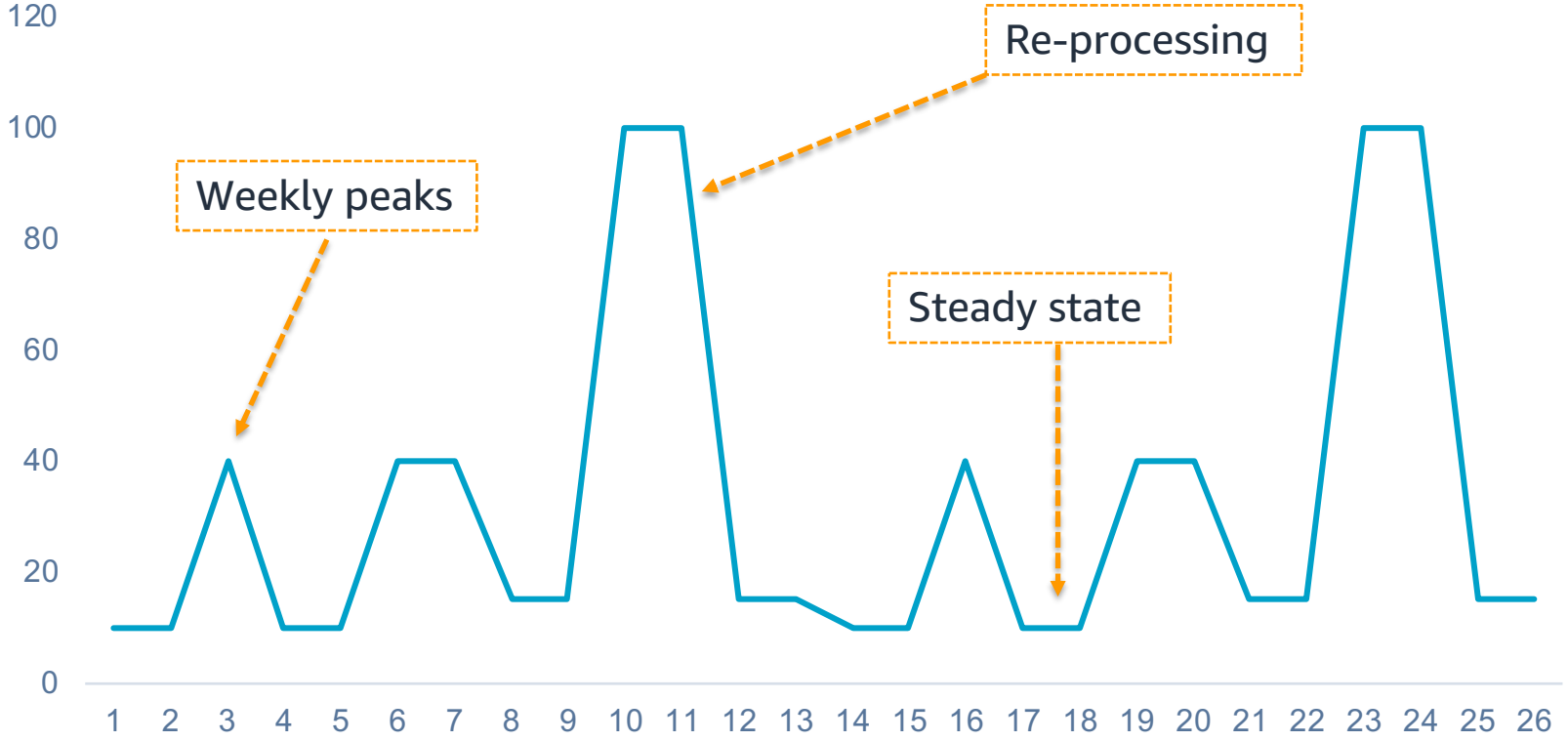
Replication adds to cost

3x

- Data is replicated several times
- Typically only in one data center

aws

Underutilized or Scarce resources



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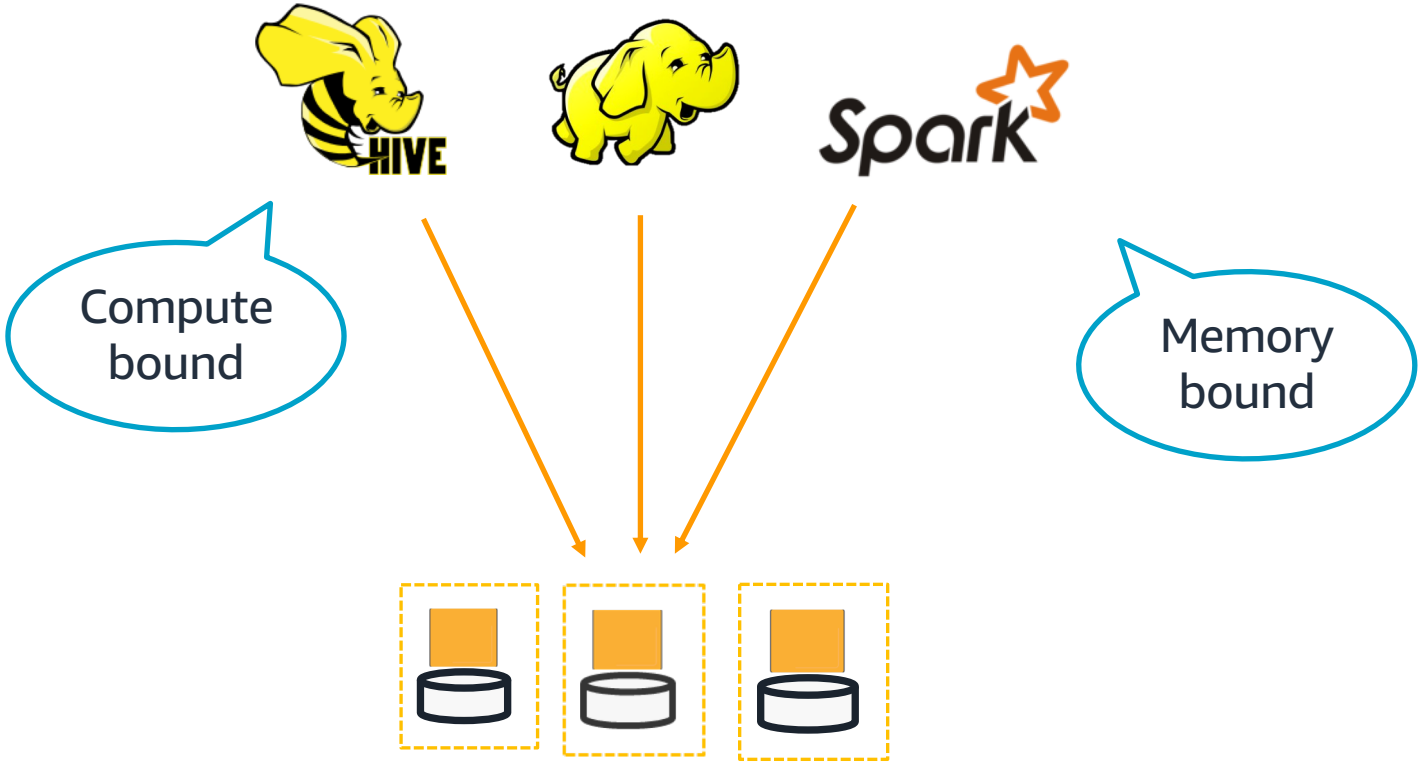
Contention for the same resources



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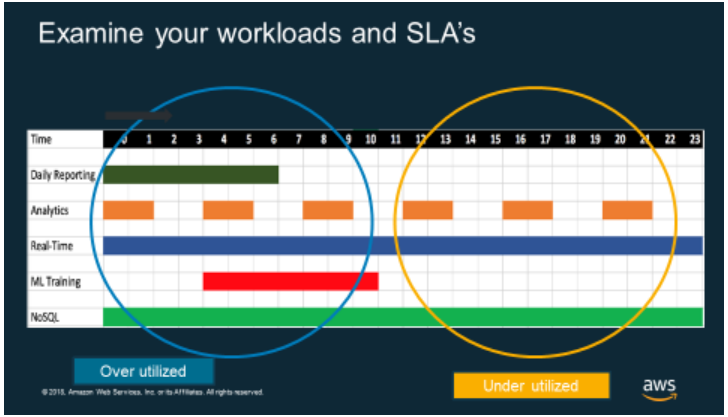
Limited on Fast Following Application Versions

With a monolithic cluster, there may be dependencies of downstream applications that impact the inability to upgrade versions. By not upgrading, organizations could be limiting innovation.

- **Large Scale Transformation:** Map/Reduce, Hive, Pig, Spark
- **Interactive Queries:** Impala, Spark SQL, Presto
- **Machine Learning:** Spark ML, MxNet, Tensorflow
- **Interactive Notebooks:** Jupyter, Zeppelin
- **NoSQL:** HBase

Summary of Challenges

1. **Fixed Cost:** Forced into entering into a multi-year commitment for HW, SW and associated Support Fees driving a sizable capital outlay.
2. **Storage / Compute:** These are tightly coupled, so even if you just want to increase storage for a data retention use case, you incur cost for unnecessary compute.
3. **Always On:** Cluster was always on, which is not resource and cost efficient. Consider the cost of power, FTE's and other data center demands.
4. **Self-Service:** Users want options to deploy only certain services such as Hive, Spark, Presto only; oftentimes just want to test a new service.
5. **Static, Not-scalable & Unused Capacity:** Always fixed number of nodes used; unable to scale based on input size of data (small data sets vs. larger data sets) and lacked consideration for cluster contention.
6. **Outages Impact:** During Production outages, no alternative means to access the cluster. Must consider the implication of downtimes.
7. **Production Upgrade:** Upgrading individual services (i.e. Hive) is laborious to run through DEV, TEST, and PROD cluster environments.
8. **Slow Deployment Cycle:** The cumulative effect of above impacts speed of readying the right infrastructure to solve business and technical use cases.



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Introducing Amazon EMR

Managed Hadoop and Spark in the cloud

Enterprise-grade

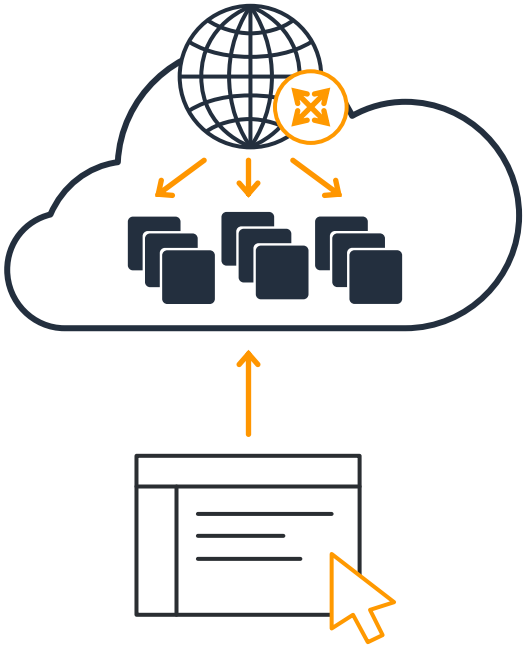
Easy

Lowest cost

aws

Easy

Spin up clusters in minutes



- Launch Hadoop & Spark clusters in minutes
- No need to install or maintain Hadoop
- Cluster tuning, and configuration done for you
- Automatically scale clusters based on policies
- Optimized for both transient and long-running clusters

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Amazon EMR

Application Index

- Amazon EMR is one of the largest Spark and Hadoop service providers in the world, enabling customers to run ETL, machine learning, real-time processing, data science, and low-latency SQL at petabyte scale.
- See the EMR Release page for up to date schedules. Users can bootstrap applications not listed below.

Administrative

- Ganglia — Cluster monitoring
- Livy — REST API interacting with Spark
- Oozie — Workflow Scheduler
- ZooKeeper — Configure & Sync node

Machine Learning

- Mahout — Machine Learning
- MXNet — Deep Learning
- SparkML — Machine Learning
- TensorFlow — Deep Learning

Data Movement

- Sqoop — Relational DB connector

NoSQL

- HBase — Hadoop's non-relational DB

Data Processing

- Flink — Stream Processing
- Hive — Hadoop Data warehouse
- MapReduce — Batch Data Processing
- Presto — Distributed SQL for Big Data
- Spark — In-memory Data Processing & Machine Learning
- Tez — Interactive Data Processing
- Hudi — Update Data Lake Storage

Query Tools

- EMR Notebooks — Serverless notebook
- Hue — Visualization and Querying for Hadoop
- JupyterHub — Multi-user Juptyer Notebook (installed on cluster)
- Phoenix — Querying for HBase
- Pig — Scripting language for MapReduce jobs
- Zeppelin — Data Science notebook

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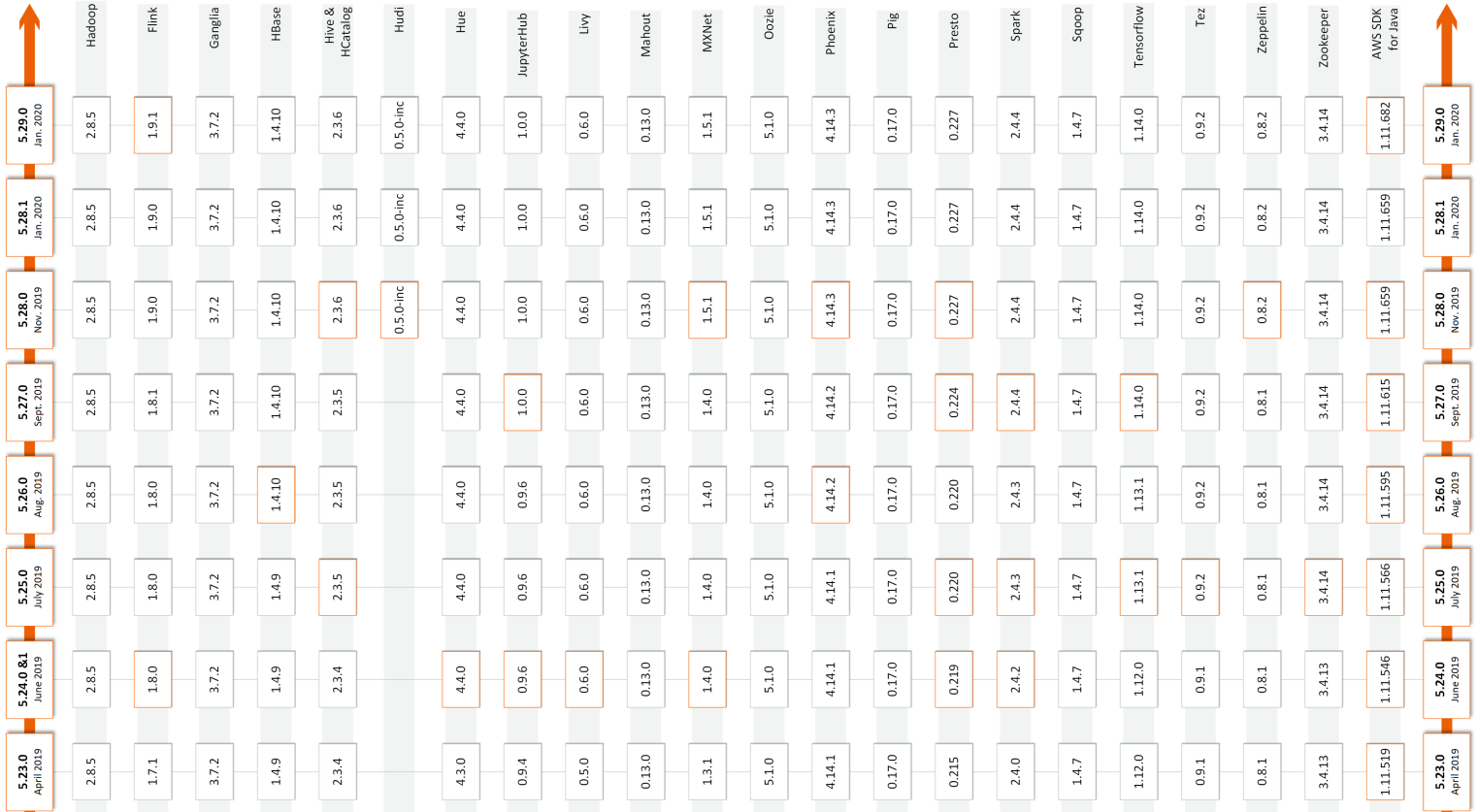
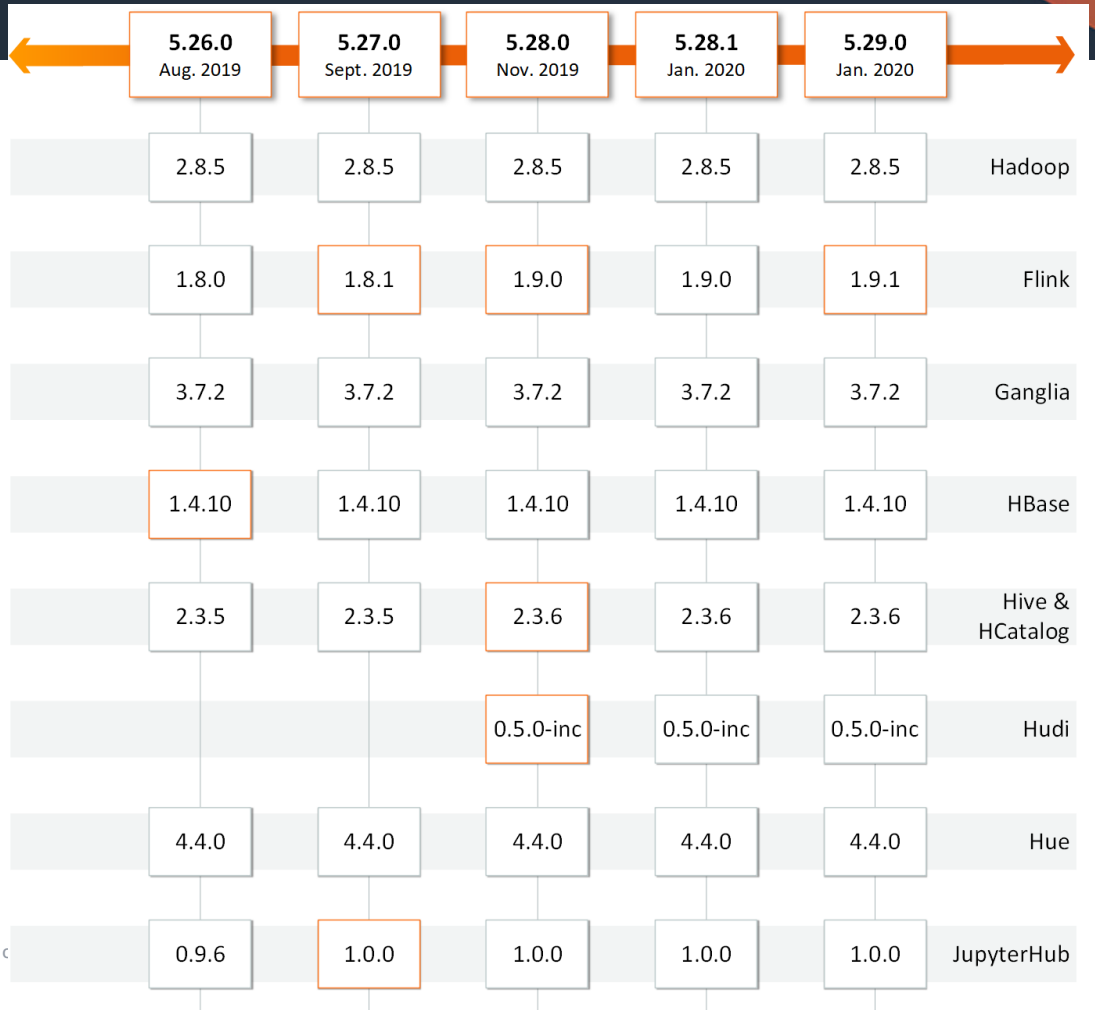
Enterprise-grade Hadoop & Spark

Deploy latest releases in Hadoop and Spark ecosystems



- 19 open-source projects: Apache Hadoop, Spark, HBase, Presto, and more
- Updated with the latest open source frameworks within 30 days of release

https://docs.aws.amazon.com/emr/latest/ReleaseGuide/emr-release-5x.html



5.26.0 Aug. 2019	5.27.0 Sept. 2019	5.28.0 Nov. 2019	5.28.1 Jan. 2020	5.29.0 Jan. 2020	
2.8.5	2.8.5	2.8.5	2.8.5	2.8.5	Hadoop
1.8.0	1.8.1	1.9.0	1.9.0	1.9.1	Flink
3.7.2	3.7.2	3.7.2	3.7.2	3.7.2	Ganglia
1.4.10	1.4.10	1.4.10	1.4.10	1.4.10	HBase
2.3.5	2.3.5	2.3.6	2.3.6	2.3.6	Hive & HCatalog
		0.5.0-inc	0.5.0-inc	0.5.0-inc	Hudi
4.4.0	4.4.0	4.4.0	4.4.0	4.4.0	Hue
0.9.6	1.0.0	1.0.0	1.0.0	1.0.0	JupyterHub

- 19 open-source projects: Apache Hadoop, Spark, HBase, Presto, and more
- Updated with the latest open source frameworks within 30 days of release

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High impact results with Amazon EMR

EPIC GAMES FORTNITE	near real-time analytics for 140M players
salesforce DMP	scales 3,000 transient clusters on a daily basis
GE POWER	powers the Predix solution processing 1,000,000 data executions/day
asurion	achieves costs savings of 55% when compared to on-demand pricing and 40% savings when compared to Reserved Instances
Zillow	computes Zestimates on 100M +homes in hours instead of 1 day

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On-premises migrations to Amazon EMR

FINRA	Processes 135B events/day and have cost savings of 60% (~$20M)
Vanguard	decreased costs by $600k in less than 5 months
airbnb	reduced cost of operation and improved Spark performance 3x
Aol.	saves 75% and is 60% more efficient
Guardian	re-architects 1 monolithic pipeline into 3 purpose built clusters

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The value of cloud-based Hadoop/Spark with Amazon EMR.

Benefits of EMR

1. Decoupled compute & storage
2. Built-in disaster recovery
3. Turn off your clusters through transient clusters
4. Agility of Auto-scaling persistent clusters
5. Leverage EC2 Spot pricing
6. Self-service with AWS Service Catalog
7. Spark performance improvements
8. Fully-managed EMR Notebooks
9. Lowest TCO in the industry, analysts confirm
10. EMR is surrounded by the industry's broadest Analytics ecosystem

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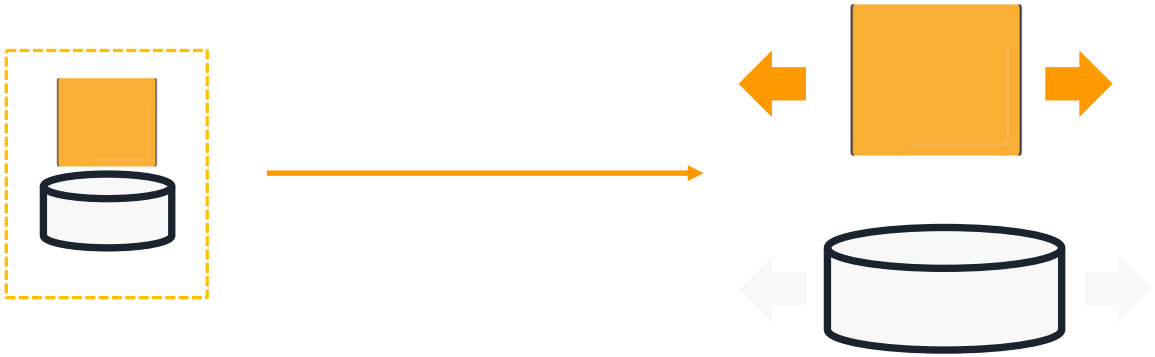
Benefit 1: Decouple storage and compute



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Benefit 1: Amazon S3 is your persistent data store

Amazon S3

- 99.9999999% durability
- Low cost and many varieties
- Life Cycle Policies
- Versioning
- Distributed by default
- EMR FS

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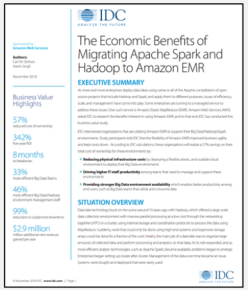
Benefits Summary

10 Benefits of migrating to Amazon EMR

1. Decoupled Compute & Storage
2. Built-in Disaster Recovery
3. Turn off your clusters through Transient clusters
4. Agility of Auto-scaling Persistent clusters
5. Leverage Spot pricing for unused EC2 capacity
6. Self-service with AWS Service Catalog
7. Spark Performance Improvements
8. Fully Managed EMR Notebooks
9. Lowest TCO in the Industry, analysts confirm
10. EMR is surrounded by the industry's broadest Analytics ecosystem

Nov. 2018, **IDC** report confirms:

"EMR provides 57% reduced costs vs. on premise resulting in 342% ROI over 5 years."


IDC

The Economic Benefits of Migrating Apache Spark and Hadoop to Amazon EMR

EXECUTIVE SUMMARY

Business Value Highlights

57%

342%

8 months

33%

46%

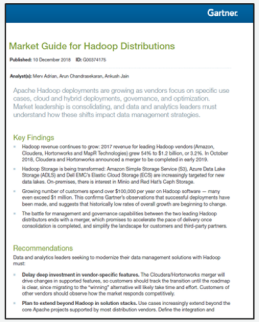
99%

$2.9 million

SITUATION OVERVIEW

Dec. 2018, **Gartner** suggests:

"AWS remains the largest Hadoop provider in terms of both revenue and user base."


Gartner

Market Guide for Hadoop Distributions

Key Findings

Recommendations

Feb. 2019, **Forrester** recognizes:

AWS EMR as the Cloud Hadoop/Spark (HARK) Leader

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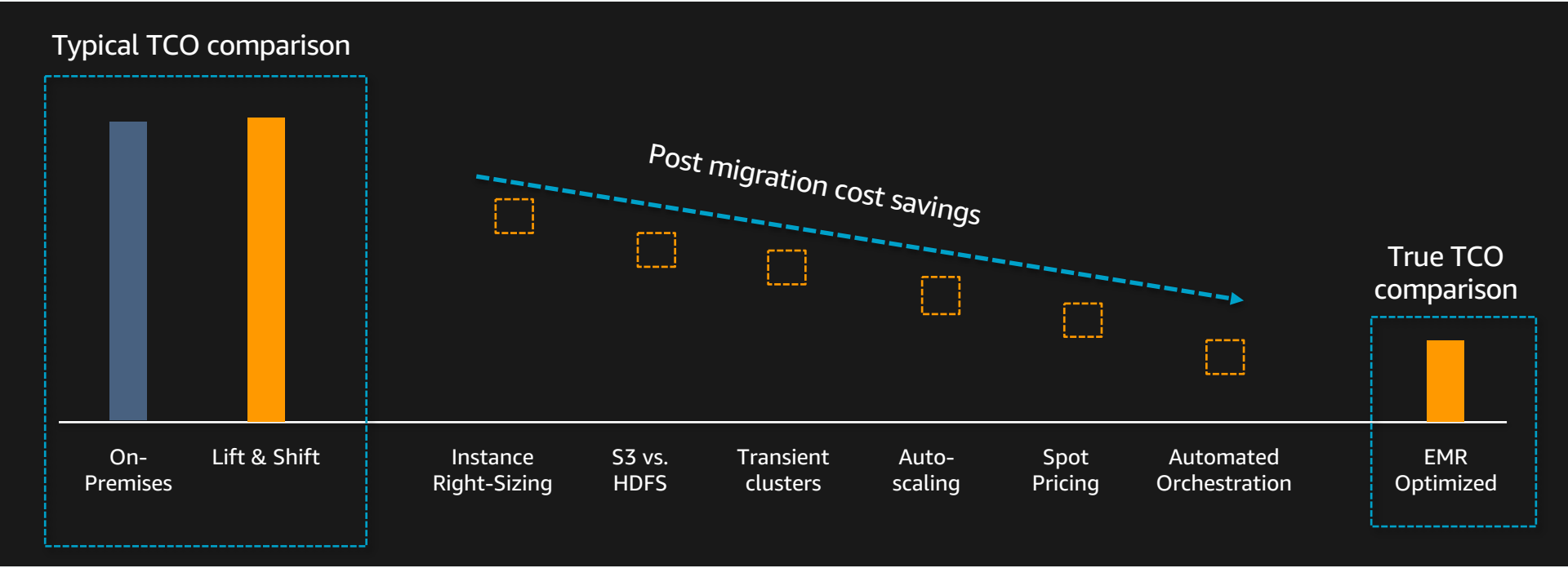
EMR Design Options

Transient vs. Persistent Cluster
Amazon S3 vs. local HDFS
Elastic Cluster vs. Static Cluster
On-Demand vs. Reserved vs. Spot
Core Nodes vs. Task Nodes

A multi-phased approach to best practice deployment

Go beyond a lift & shift to optimize for scale and cost.



Resources

Service page
https://aws.amazon.com/emr

Getting started
https://aws.amazon.com/emr/getting-started/

EMR Migration Program
https://aws.amazon.com/emr/emr-migration

AWS Big Data Blog
https://aws.amazon.com/blogs/big-data/

EMR Cluster Creation

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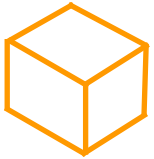
Creation Options

AWS Management Console

AWS CLI



AWS SDKs

Create Cluster - Advanced Options

Go to quick options

- **Step 1: Software and Steps**
- Step 2: Hardware
- Step 3: General Cluster Settings
- Step 4: Security

Software Configuration

Release emr-5.24.1

☑ Hadoop 2.8.5	☐ Zeppelin 0.8.1	☐ Livy 0.6.0
☐ JupyterHub 0.9.6	☐ Tez 0.9.1	☐ Flink 1.8.0
☐ Ganglia 3.7.2	☐ HBase 1.4.9	☑ Pig 0.17.0
☑ Hive 2.3.4	☐ Presto 0.219	☐ ZooKeeper 3.4.13
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☑ Hue 4.4.0	☐ Phoenix 4.14.1	☐ Oozie 5.1.0
☐ Spark 2.4.2	☐ HCatalog 2.3.4	☐ TensorFlow 1.12.0

Multi-master support

☐ Enable multi-master support

AWS Glue Data Catalog settings (optional)

☐ Use for Hive table metadata

Edit software settings

◉ Enter configuration ○ Load JSON from S3

```
classification=config-file-name,properties=[myKey1=myValue1,myKey2=myValue2]
```

Add steps (optional)

Step type Select a step — Configure

☐ Auto-terminate cluster after the last step is completed

Cancel Next

EMR Multi-Master

- When selected EMR multi-master will create a cluster with three master nodes
- Multi-master grants support for high availability for Hbase, YARN Resource Manager, HDFS Name Node, Spark, Hive, and Ganglia
- With multi-master Amazon EMR automatically fails over to a standby master node if the primary master node fails

Create Cluster - Advanced Options

Go to quick options

- **Step 1: Software and Steps**
- Step 2: Hardware
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- Step 4: Security

Software Configuration

Release emr-5.24.1

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Multi-master support

☐ Enable multi-master support

AWS Glue Data Catalog settings (optional)

☐ Use for Hive table metadata
☐ Use for Presto table metadata
☐ Use for Spark table metadata

Edit software settings

◉ Enter configuration ○ Load JSON from S3

```
classification=config-file-name,properties=[myKey1=myValue1,myKey2=myValue2]
```

Add steps (optional)

Step type Select a step — Configure

☐ Auto-terminate cluster after the last step is completed

Cancel Next

Glue Data Catalog Settings

- Specify the Glue data catalog as your external metastore supported in Hive, Spark, and Presto
- This configuration option is useful when you require a persistent metastore or a metastore shared by different clusters, services, applications, or AWS accounts

Create Cluster - Advanced Options

Go to quick options

- **Step 1: Software and Steps**
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Software Configuration

Release emr-5.24.1

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Multi-master support

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AWS Glue Data Catalog settings (optional)

☐ Use for Hive table metadata

Edit software settings

◉ Enter configuration ○ Load JSON from S3

```
classification=config-file-name,properties=[myKey1=myValue1,myKey2=myValue2]
```

Add steps (optional)

Step type Select a step — Configure

☐ Auto-terminate cluster after the last step is completed

Cancel Next

Edit Software Settings

- Override default configurations for Hadoop applications
- Inline or JSON file from S3
- capacity-scheduler, core-site, hadoop-env, hadoop-log4j, hdfs-site, httpfs-env, https-site, mapred-env, mapred-site, yarn-env, yarn-site, hive-env, hive-exec-log4j, hive-log4j, hive-site, pig-properties, pig-log4j etc.

Create Cluster - Advanced Options

Go to quick options

- **Step 1: Software and Steps**
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Software Configuration

Release emr-5.24.1

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☐ Use for Hive table metadata

☐ Use for Presto table metadata

☐ Use for Spark table metadata

Edit software settings

◉ Enter configuration ○ Load JSON from S3

```
classification=config-file-name,properties=[myKey1=myValue1,myKey2=myValue2]
```

Add steps (optional)

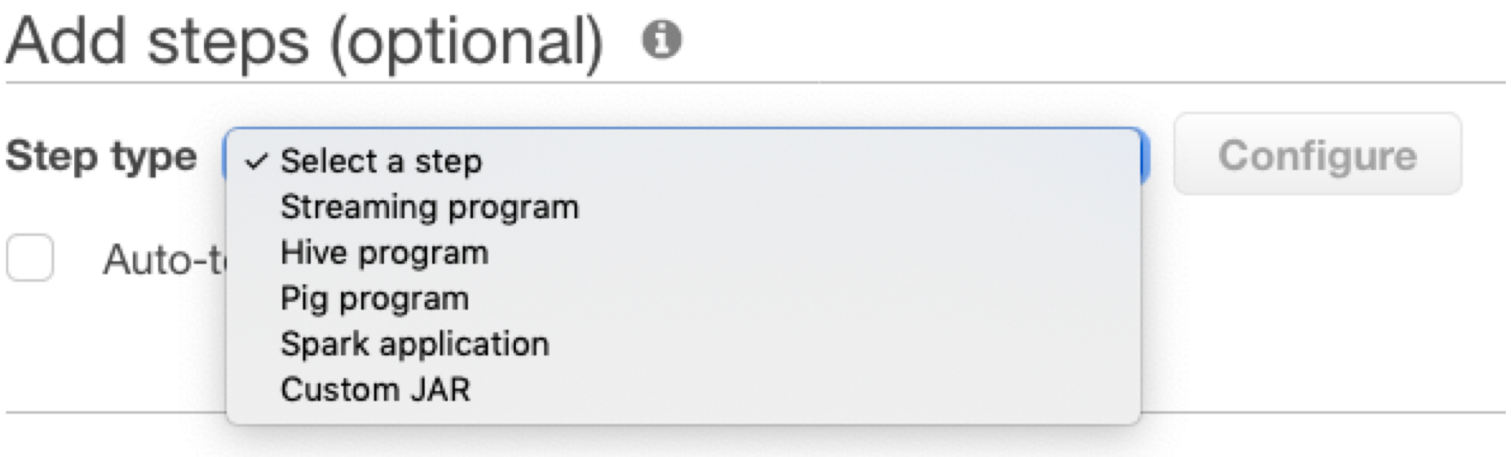
Step type Select a step — Configure

☐ Auto-terminate cluster after the last step is completed

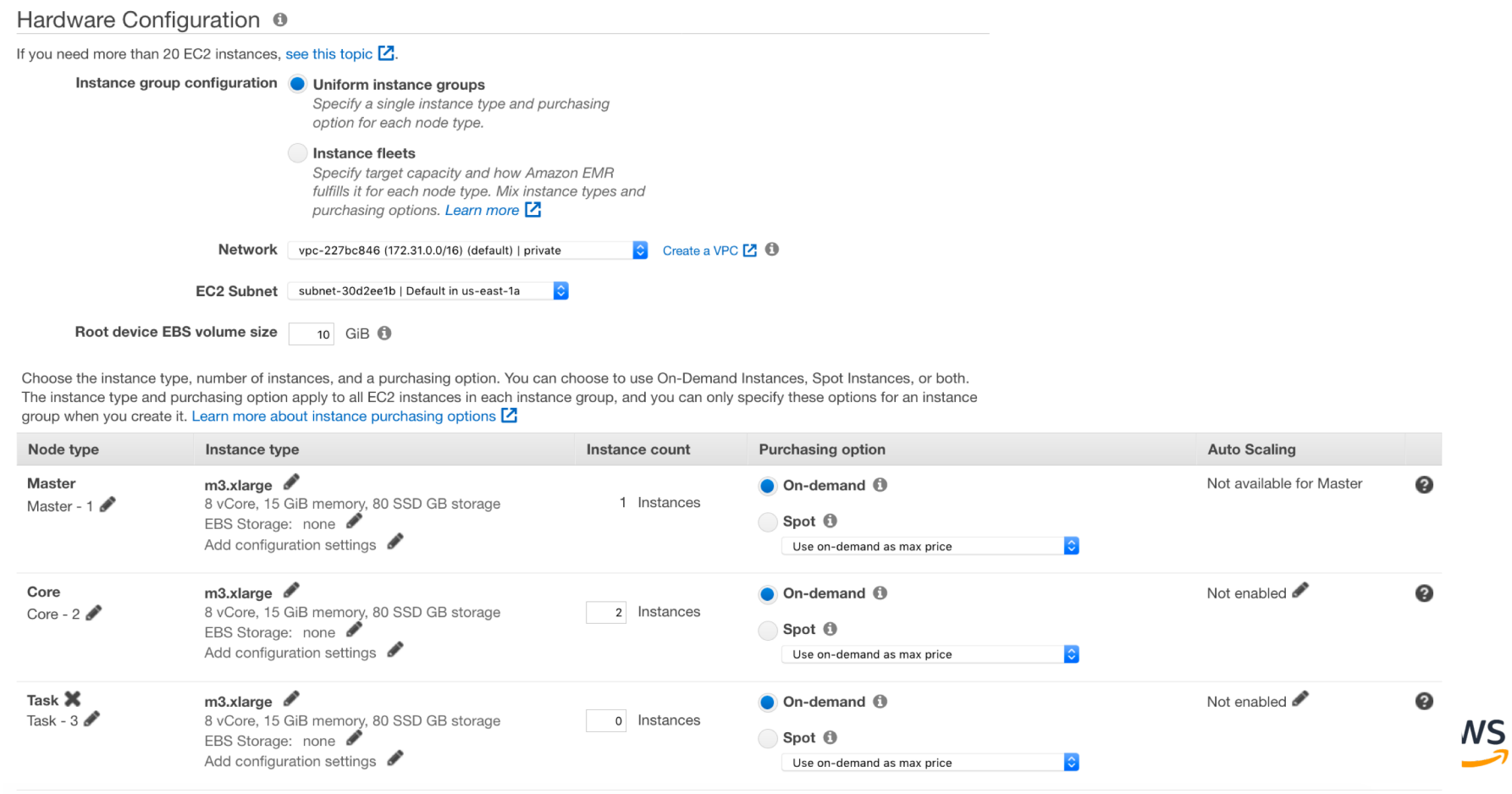
Cancel **Next**

Add Steps

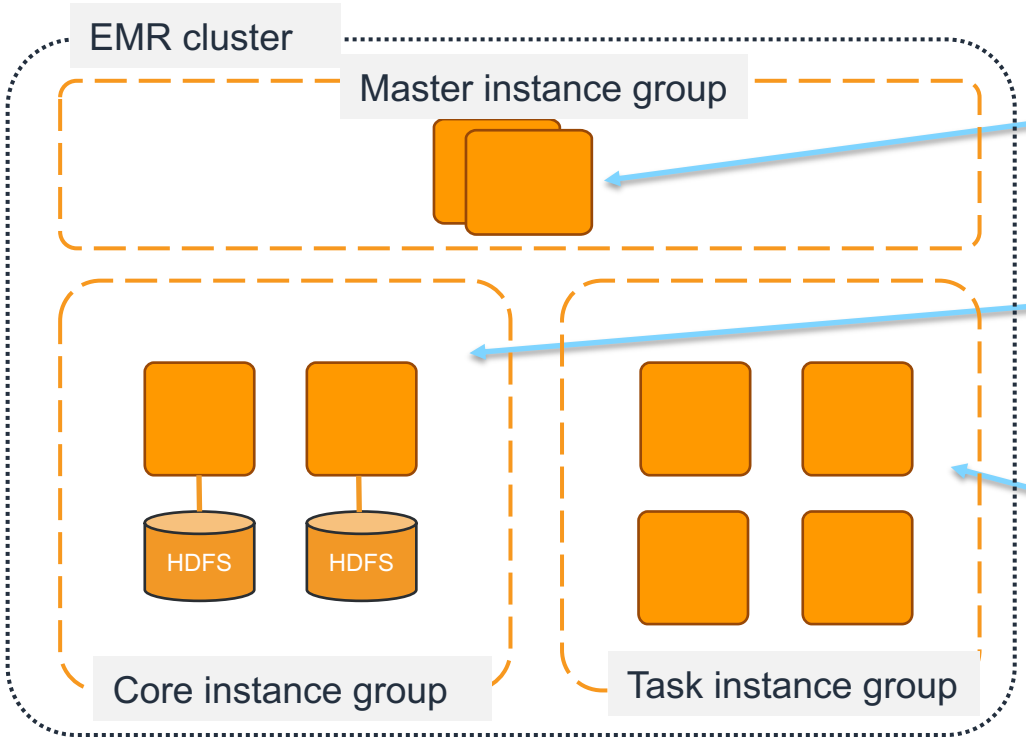
- A step is a unit of work you submit to the cluster
- Can choose to auto-terminate cluster upon completion
- Preconfigured options for streaming, Hive, Pig, Spark, and customer JARs



Hardware Configuration



EMR Clusters



Master Node(s) must keep running

Core nodes can be added and removed gracefully

Cluster can tolerate loss of task nodes.

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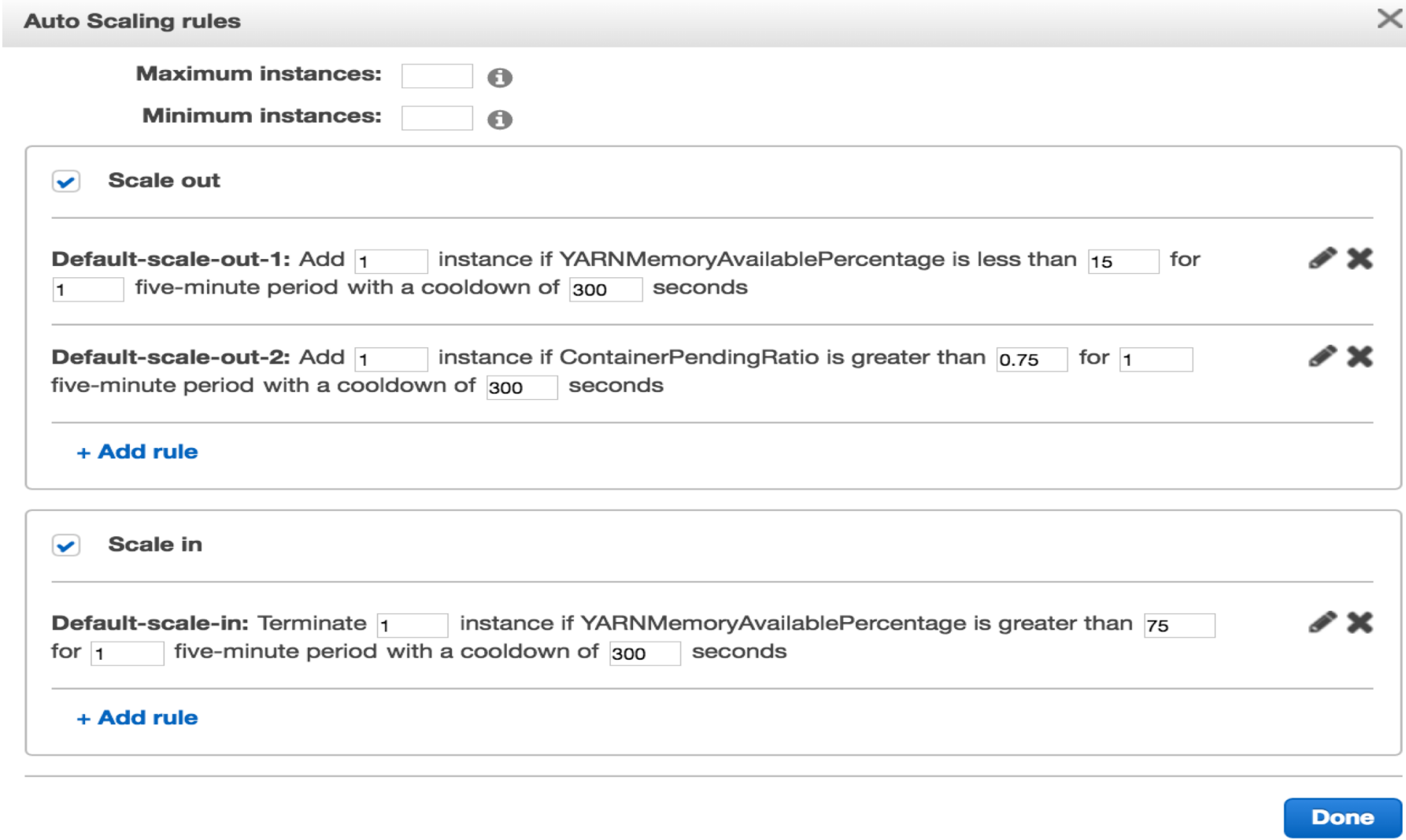

Auto Scaling rules
Maximum instances:
Minimum instances:
Scale out
Default-scale-out-1: Add 1 instance if YARNMemoryAvailablePercentage is less than 15 for 1 five-minute period with a cooldown of 300 seconds
Default-scale-out-2: Add 1 instance if ContainerPendingRatio is greater than 0.75 for 1 five-minute period with a cooldown of 300 seconds
+ Add rule
Scale in
Default-scale-in: Terminate 1 instance if YARNMemoryAvailablePercentage is greater than 75 for 1 five-minute period with a cooldown of 300 seconds
+ Add rule
Done

General Options and Tags

General Options

Cluster name My cluster

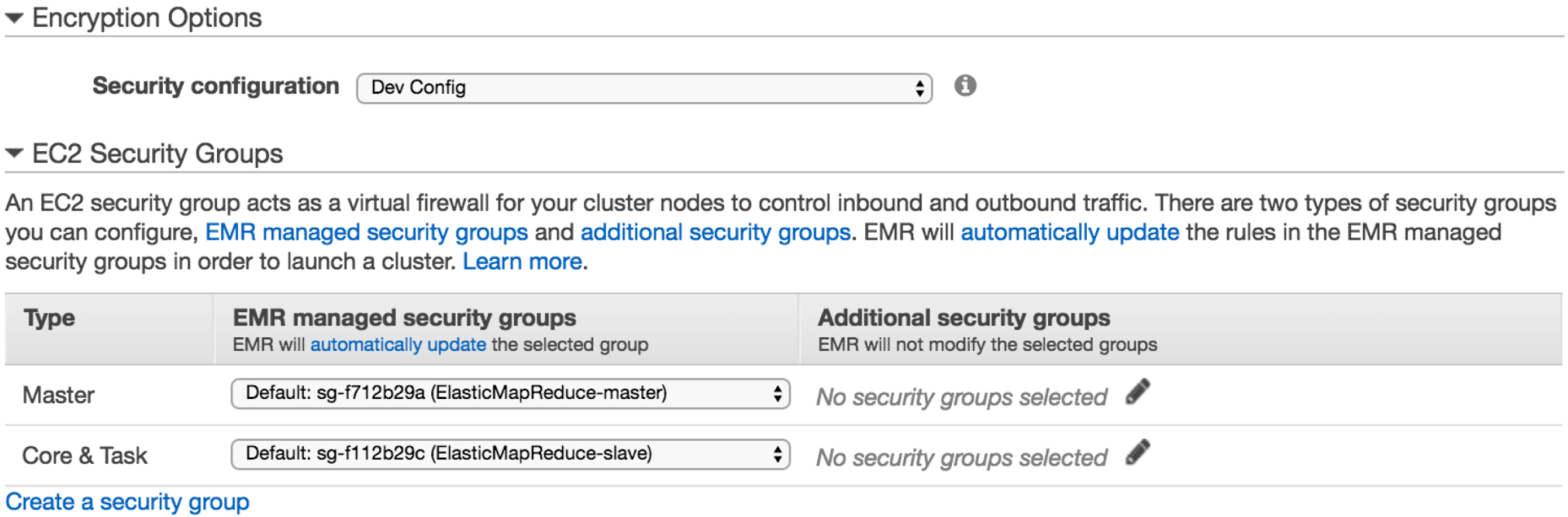
- [x] Logging
  - S3 folder s3://aws-logs-1234567890-us-east-1/elasticmapreduce/
- [x] Debugging
- [x] Termination protection

Tags

Key	Value (optional)	
Environment	Dev	✖
Team	Software	✖
Add a key to create a tag		

aws

Security – Security Configuration & Security Groups



aws

Create security configuration

Needs to be created before you start cluster creation

Name Dev Config

At-rest encryption

Enable and choose options for at-rest data encryption features in Amazon EMR, including Amazon S3 with EMRFS, local volumes attached to cluster instances, and block-transfer encryption for HDFS. Learn more

S3 encryption

Encryption mode SSE-KMS

AWS KMS Key SSE-RedshiftCOPY

Local disk encryption

Key provider type AWS KMS

AWS KMS Key Enter a Key ARN

In-transit encryption

Enable and choose options for open-source encryption features that apply to in-transit data for specific applications. Available encryption options may vary by Amazon EMR release. Learn more

TLS certificate provider

Certificate provider type PEM

S3 object s3://

Authentication

Kerberos

Enable Kerberos authentication for interactions between certain application components on your cluster using Kerberos principals. You can choose between having EMR install a KDC server on the master node of the cluster or you can share your own KDC details that EMR cluster can use. Learn more

Provider Cluster dedicated KDC External KDC

Ticket lifetime 24 **hours**

Admin server *server.example.com:749*

KDC server *server.example.com:88*

Active Directory integration

Specify local or external KDC

IAM roles for EMRFS

Use IAM roles for EMRFS requests to Amazon S3

When an Amazon S3 request is made through EMRFS, each **Basis for access** is evaluated in order. EMRFS assumes the corresponding **IAM role** for the first match. Specify the cluster **Users** or **Groups**, or **S3 prefixes** as the **Basis for access**. If no **Basis for access** matches the request, EMRFS uses the cluster's EMR role for EC2. Learn more

IAM role	Basis for access Users or groups are matched to the cluster application identity making the request.	
Admin	Users	*Enter user names, separated by comma*

+ Add role mapping

Labs

Agenda

7:00 AM – 7:15 AM. Welcome and Introductions

7:15 AM - 8:00 AM. Introduction to Amazon EMR

8:00 AM – 8:15 AM. Break / Q &A

8:15 AM – 8:45 AM. EMR Cluster Creation Overview

8:45 AM – 9:15 AM. Lab – EMR Cluster Creation

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9:30 AM – 10:00 AM. Lab – Hive, Pig, & EMR

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12:00 PM – 12:45 PM. Lab – Spark-based ETL and Notebooks on EMR

12:45 PM – 1:00 PM. Close Out and Next Steps

To participate in the labs, please send an email to **dbayard@amazon.com**

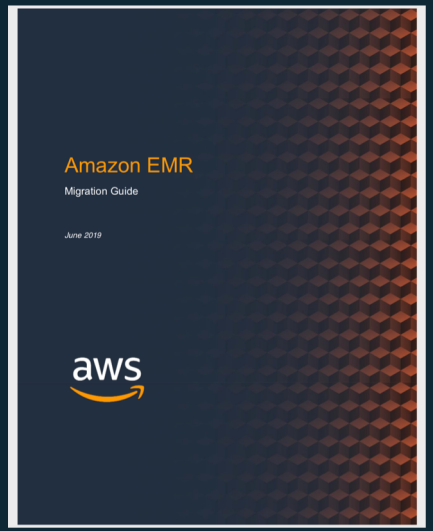
EMR Well Architected

Feb 24, 2020

Tip #1: EMR Migration Program

EMR Migration Program & EMR Migration Guide

https://aws.amazon.com/emr/emr-migration/



Contents

aws

Tip #2: Use S3

s3 and s3a

's3://' URI with EMR is the EMRFS Hadoop filesystem implementation.

EMRFS provides features such as Consistent View, S3 Client-Side Encryption, S3 Server-Side Encryption, highly-tuned S3 performance for EMR use-cases, etc:
https://docs.aws.amazon.com/emr/latest/ManagementGuide/emr-fs.html
https://docs.aws.amazon.com/emr/latest/ManagementGuide/emr-plan-file-systems.html

s3a:// is open source and is not maintained by AWS, as such we do not provide engineering support for s3a. s3a does work with EMR, however it's the responsibility of the user to troubleshoot s3a issues.

aws

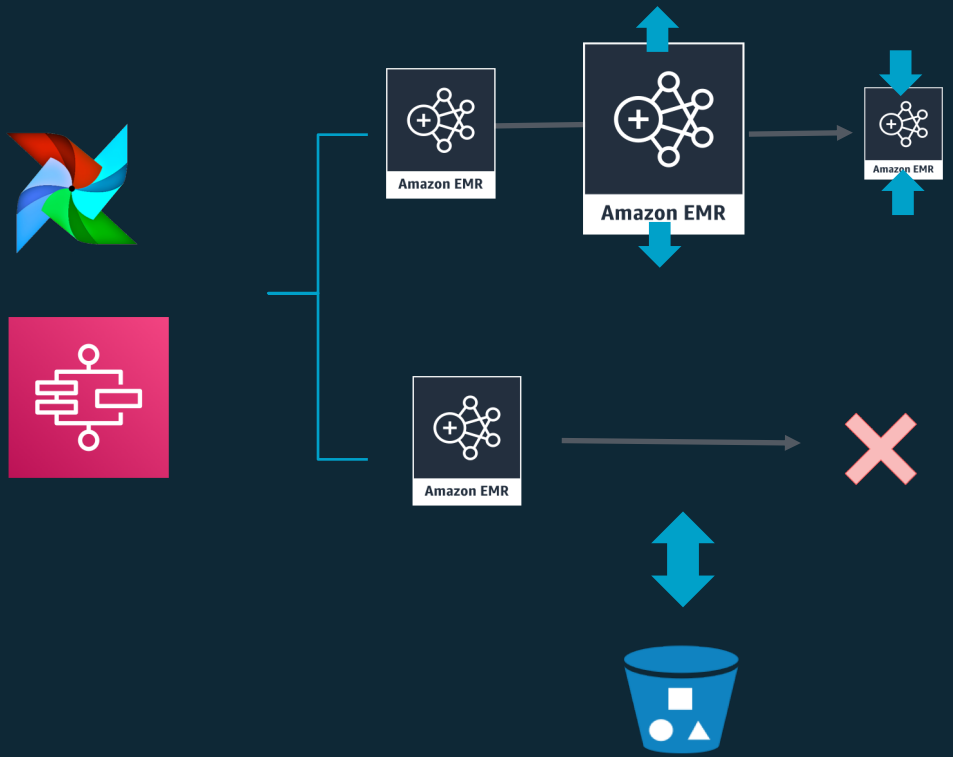
Amazon S3 tips: Partitions, compression, and file formats

- Partition your data for improved read performance
  - Read only files the query needs
  - Reduce amount of data scanned
- Optimize file sizes
  - Avoid files that are too small (generally, anything less than 128MB)
  - Fewer calls to S3 (faster listing)
  - Fewer network/HDFS requests
- Compress data set to minimize bandwidth from S3 to EC2
  - Make sure you use splittable compression or have each file be the optimal size for parallelization on your cluster
- Columnar file formats like Parquet can give increased performance on reads

Cloud Native Patterns: Architect for Elasticity

aws

Use cloud-native patterns for efficient resource use



Long running & auto scaling cluster

Purpose-built, job-scoped clusters

How do you decide?

Long-running and auto scaling

1. Great for lines of business clusters
2. Great for short-running jobs
3. Ideal to save costs for multi-tenanted data science and data engineering jobs

Transient and job scoped

1. Work well for long-running, job-scoped pipelines
2. Separating production pipelines into job-scoped clusters reduces blast radius

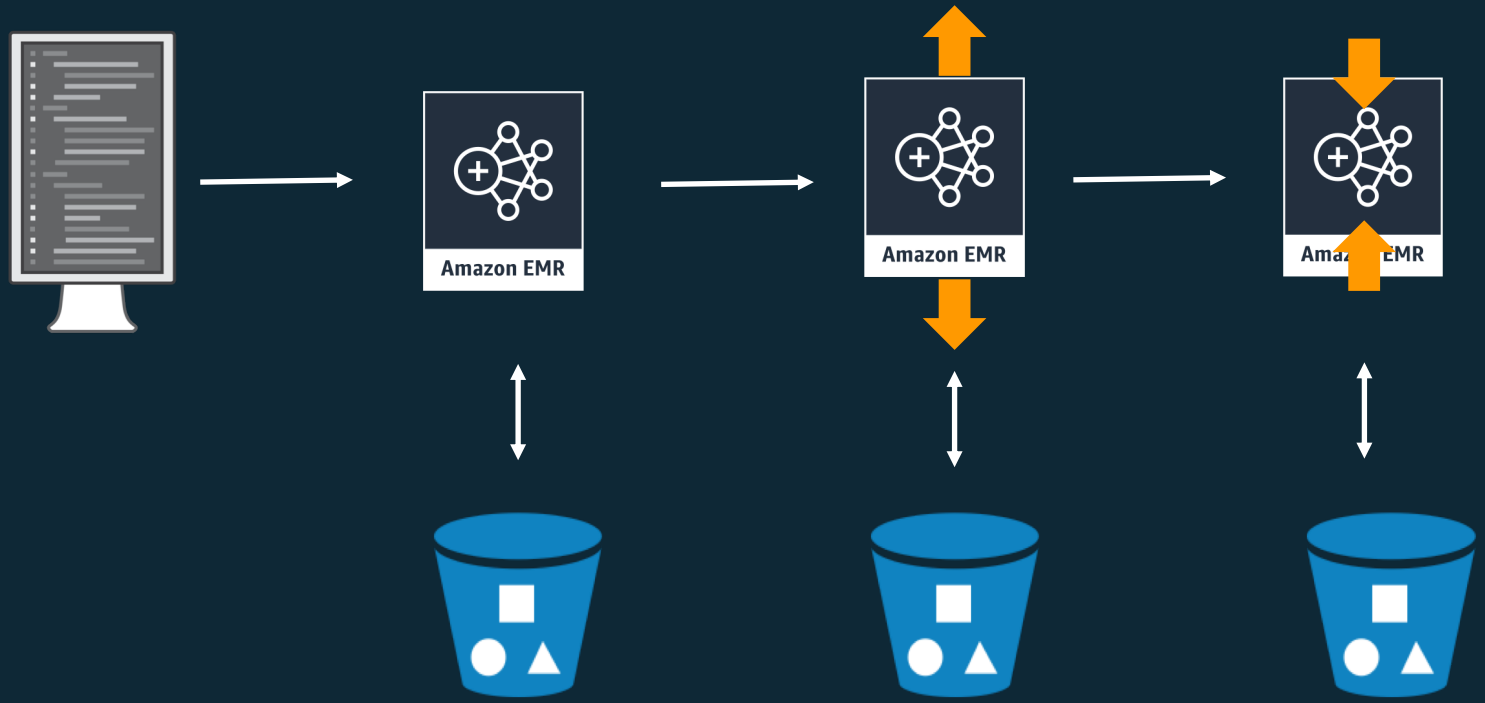
aws

Persistent Clusters

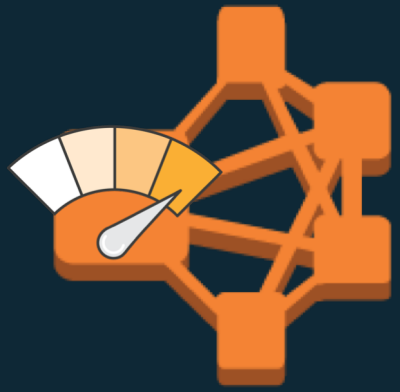
"Scale up and down"

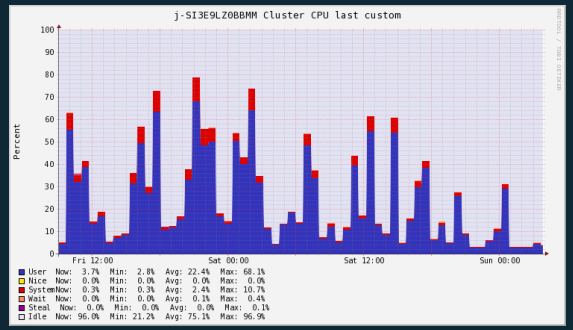
aws

Persistent Clusters



Auto Scaling Clusters

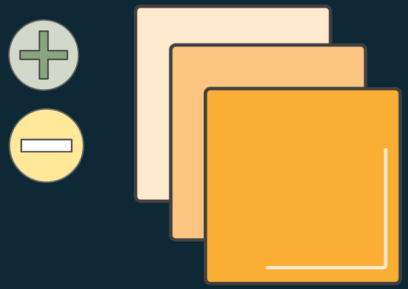




Threshold

CloudWatch or custom metric

Scaling options



aws

Hardware Configuration

Hardware Configuration

If you need more than 20 EC2 instances, see this topic.

Instance group configuration

- **Uniform instance groups** — *Specify a single instance type and purchasing option for each node type.*
- **Instance fleets** — *Specify target capacity and how Amazon EMR fulfills it for each node type. Mix instance types and purchasing options. Learn more*

Network vpc-227bc846 (172.31.0.0/16) (default) | private — Create a VPC

EC2 Subnet subnet-30d2ee1b | Default in us-east-1a

Root device EBS volume size 10 GiB

Choose the instance type, number of instances, and a purchasing option. You can choose to use On-Demand Instances, Spot Instances, or both. The instance type and purchasing option apply to all EC2 instances in each instance group, and you can only specify these options for an instance group when you create it. Learn more about instance purchasing options

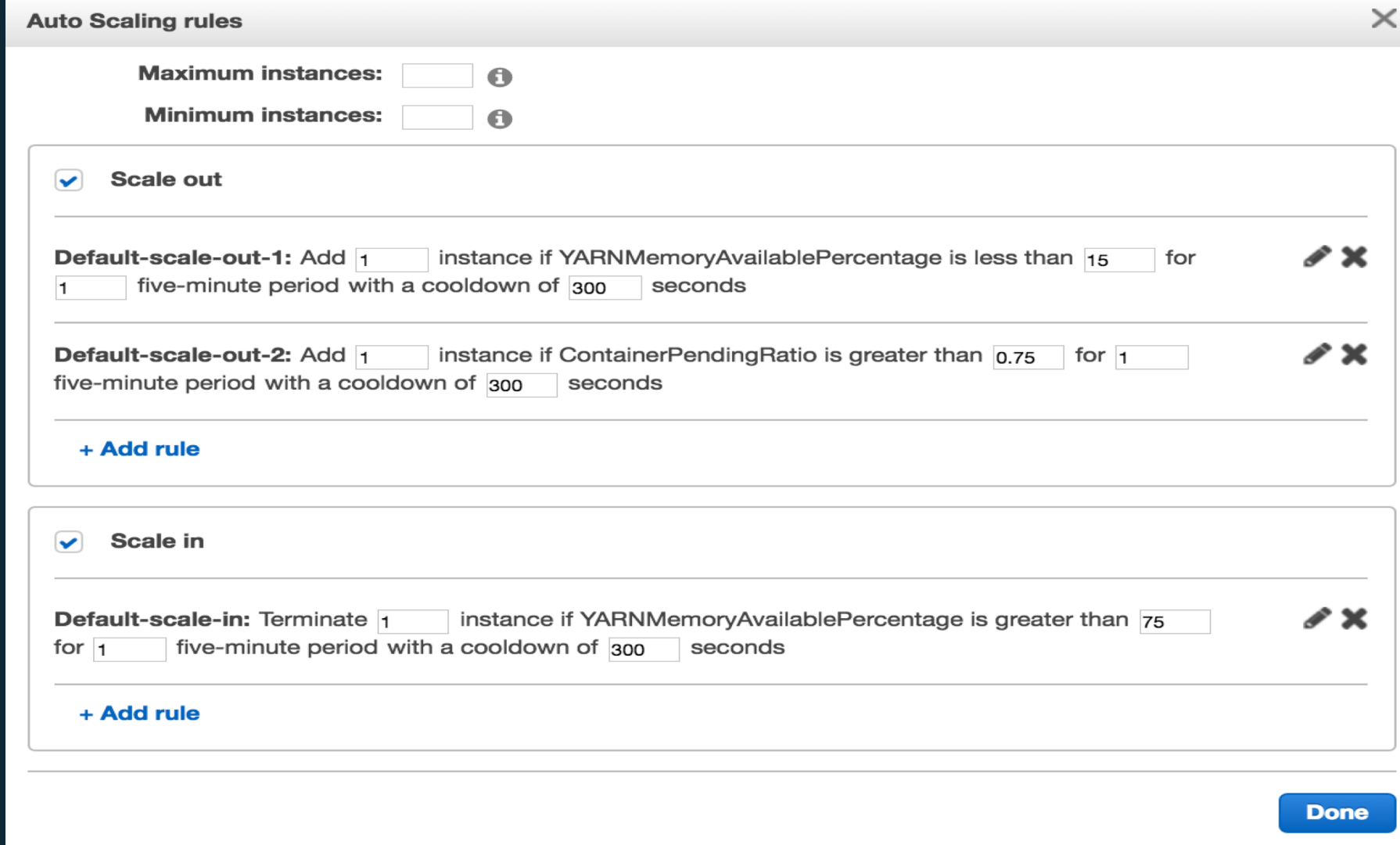
Node type	Instance type	Instance count	Purchasing option	Auto Scaling
Master Master - 1	**m3.xlarge** 8 vCore, 15 GiB memory, 80 SSD GB storage EBS Storage: none Add configuration settings	1 Instances	**On-demand** **Spot** Use on-demand as max price	Not available for Master
Core Core - 2	**m3.xlarge** 8 vCore, 15 GiB memory, 80 SSD GB storage EBS Storage: none Add configuration settings	2 Instances	**On-demand** **Spot** Use on-demand as max price	Not enabled
Task Task - 3	**m3.xlarge** 8 vCore, 15 GiB memory, 80 SSD GB storage EBS Storage: none Add configuration settings	0 Instances	**On-demand** **Spot** Use on-demand as max price	Not enabled

Hardware Configuration – Auto Scaling

Node type	Instance type	Instance count	Purchasing option	Auto Scaling
Master Master - 1	**m3.xlarge** 8 vCore, 15 GiB memory, 80 SSD GB storage EBS Storage: none Add configuration settings	1 Instances	(●) On-demand ( ) Spot Set max price per instance/hr $ 0.266	Not available for Master
Core Core - 2	**m3.xlarge** 8 vCore, 15 GiB memory, 80 SSD GB storage EBS Storage: none Add configuration settings	2 Instances	(●) On-demand ( ) Spot Use on-demand as max price	Not enabled
Task ✖ Task - 3	**m3.xlarge** 8 vCore, 15 GiB memory, 80 SSD GB storage EBS Storage: none Add configuration settings	0 Instances	( ) On-demand (●) Spot Set max price per instance/hr $ 0.266	Not enabled

Auto scaling option

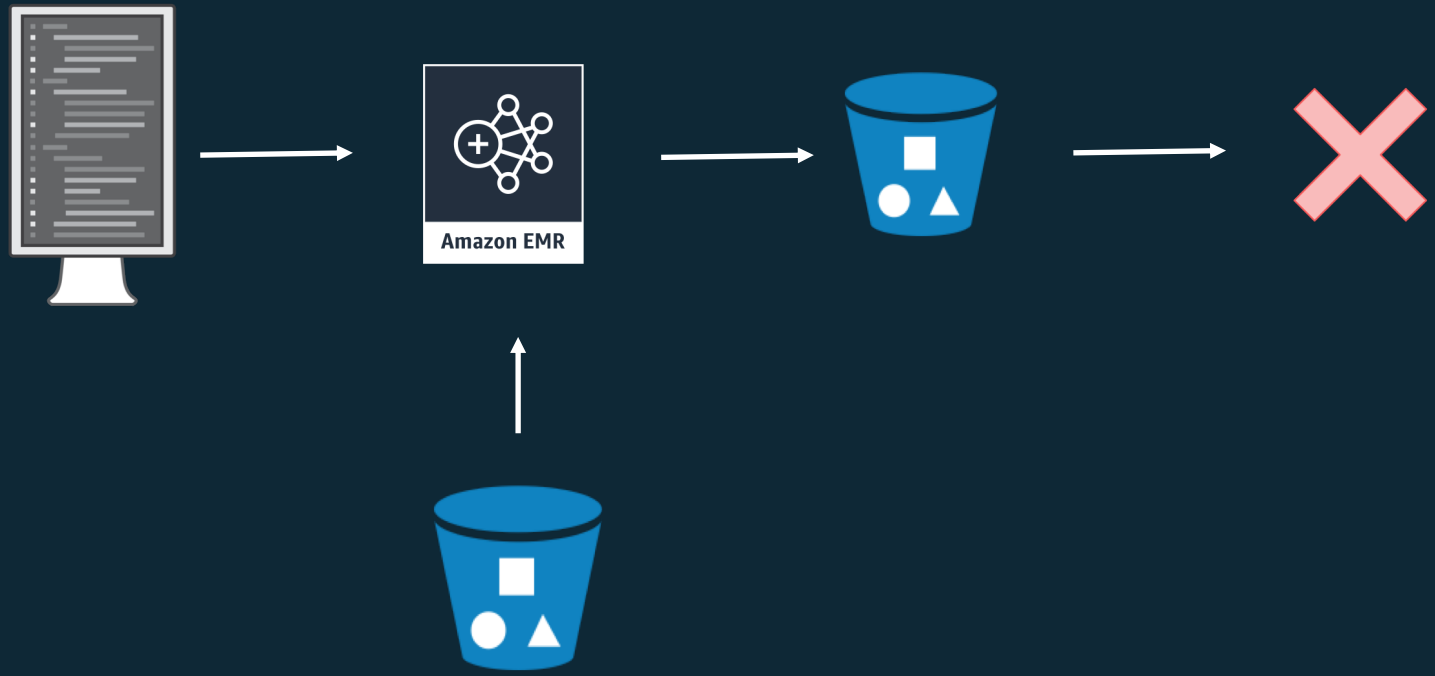
aws


Auto Scaling rules
Maximum instances:
Minimum instances:
Scale out
Default-scale-out-1: Add 1 instance if YARNMemoryAvailablePercentage is less than 15 for 1 five-minute period with a cooldown of 300 seconds
Default-scale-out-2: Add 1 instance if ContainerPendingRatio is greater than 0.75 for 1 five-minute period with a cooldown of 300 seconds
+ Add rule
Scale in
Default-scale-in: Terminate 1 instance if YARNMemoryAvailablePercentage is greater than 75 for 1 five-minute period with a cooldown of 300 seconds
+ Add rule
Done

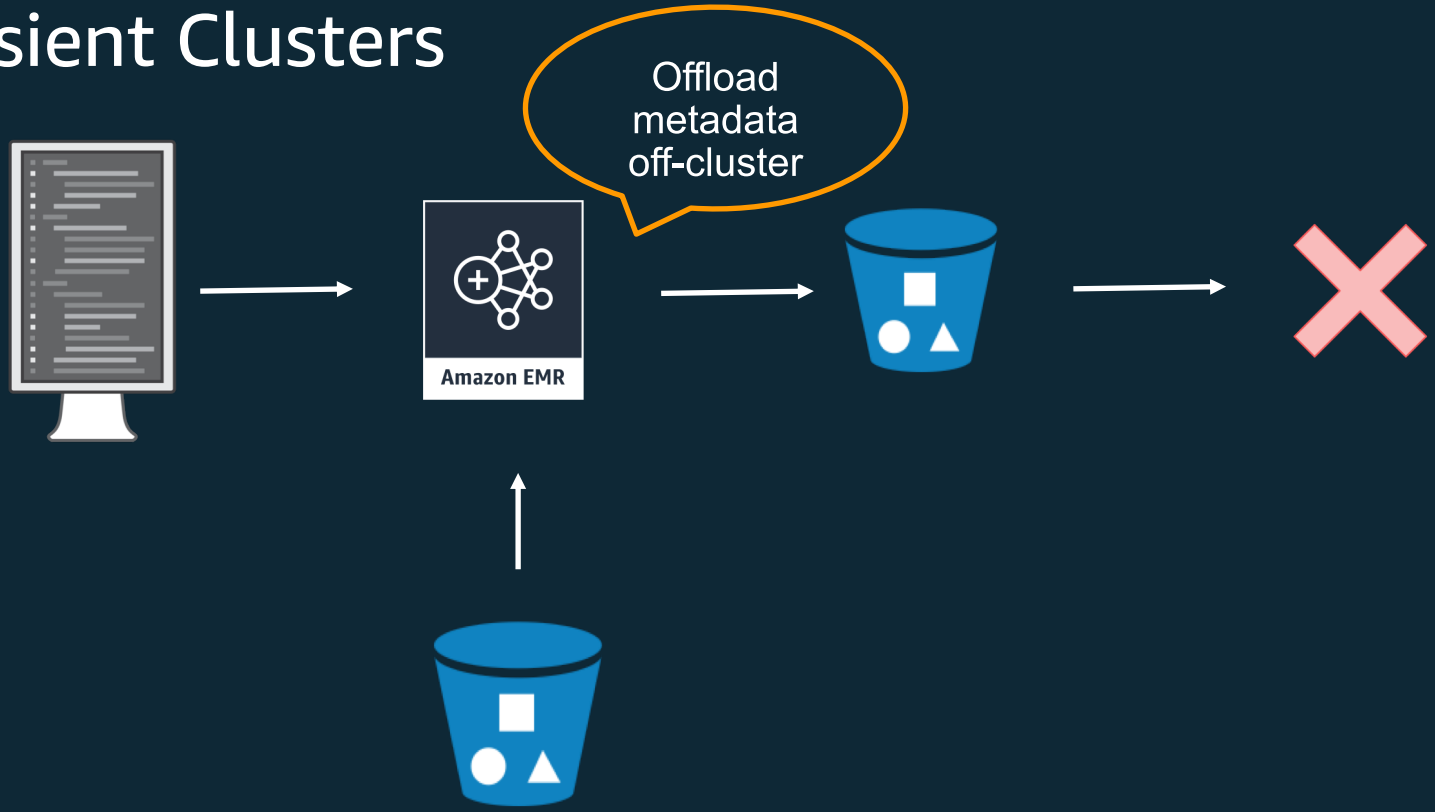
Transient Clusters

“Run stateless, Automate everything, Enable self-service”

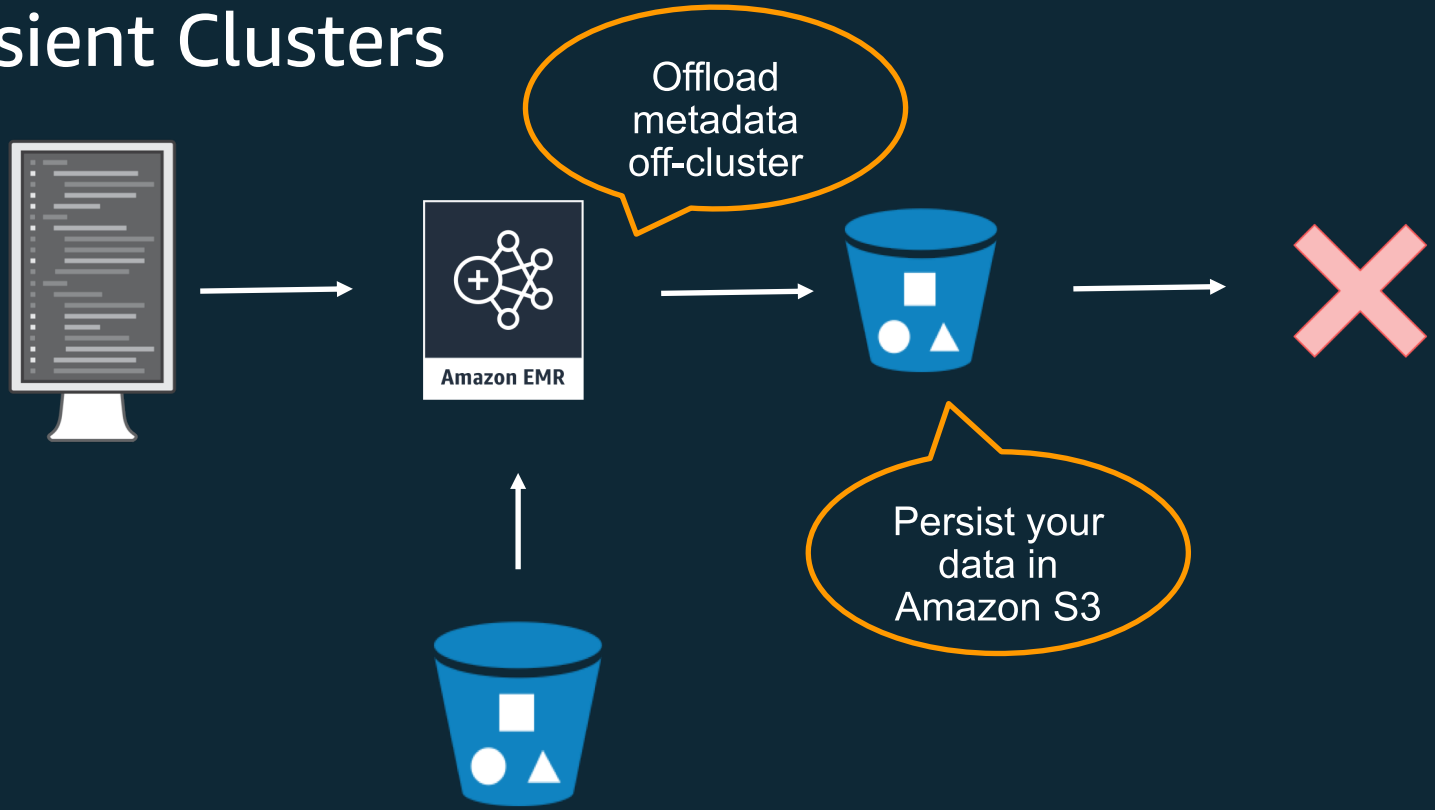
Transient Clusters



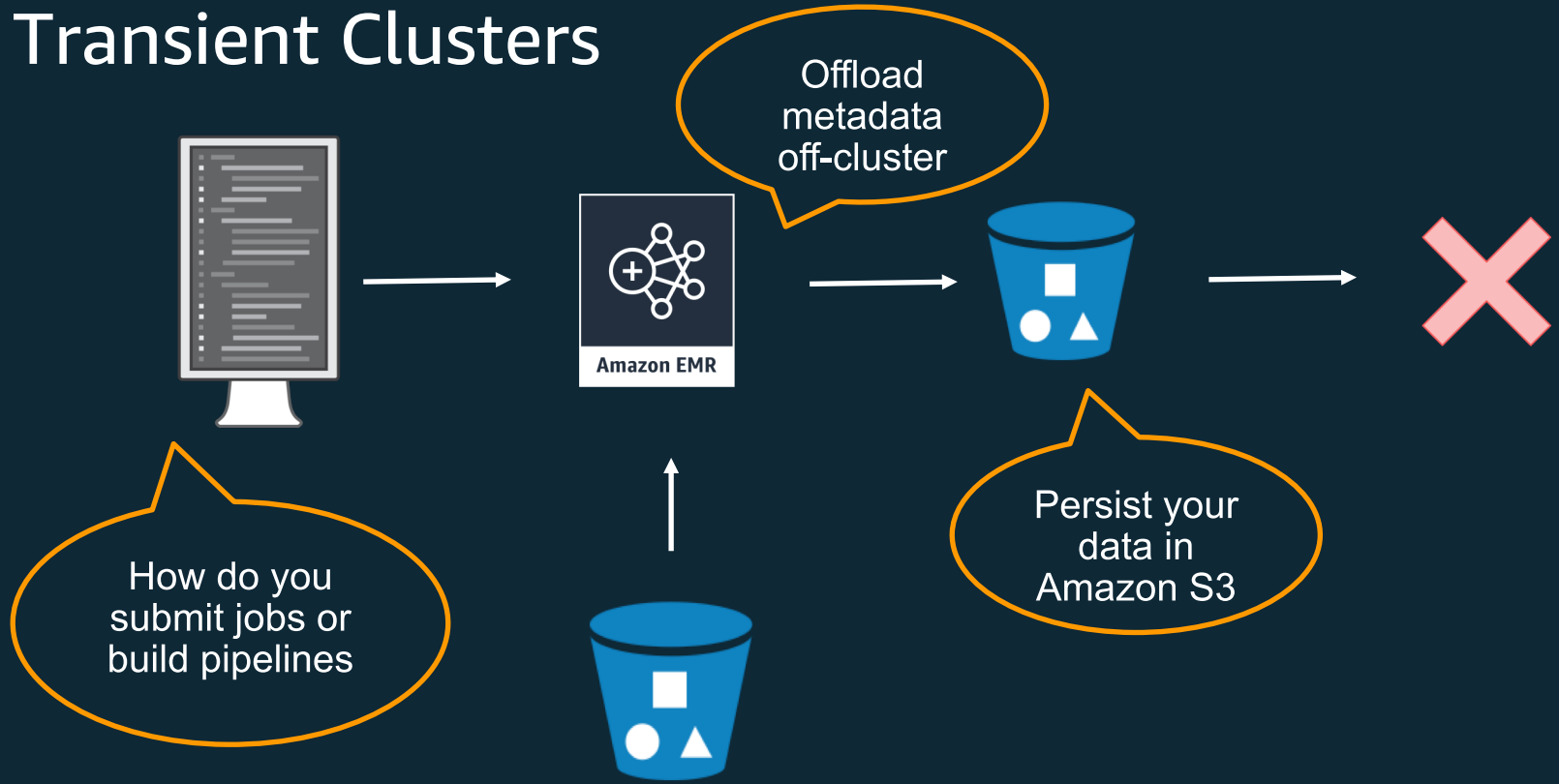
Transient Clusters



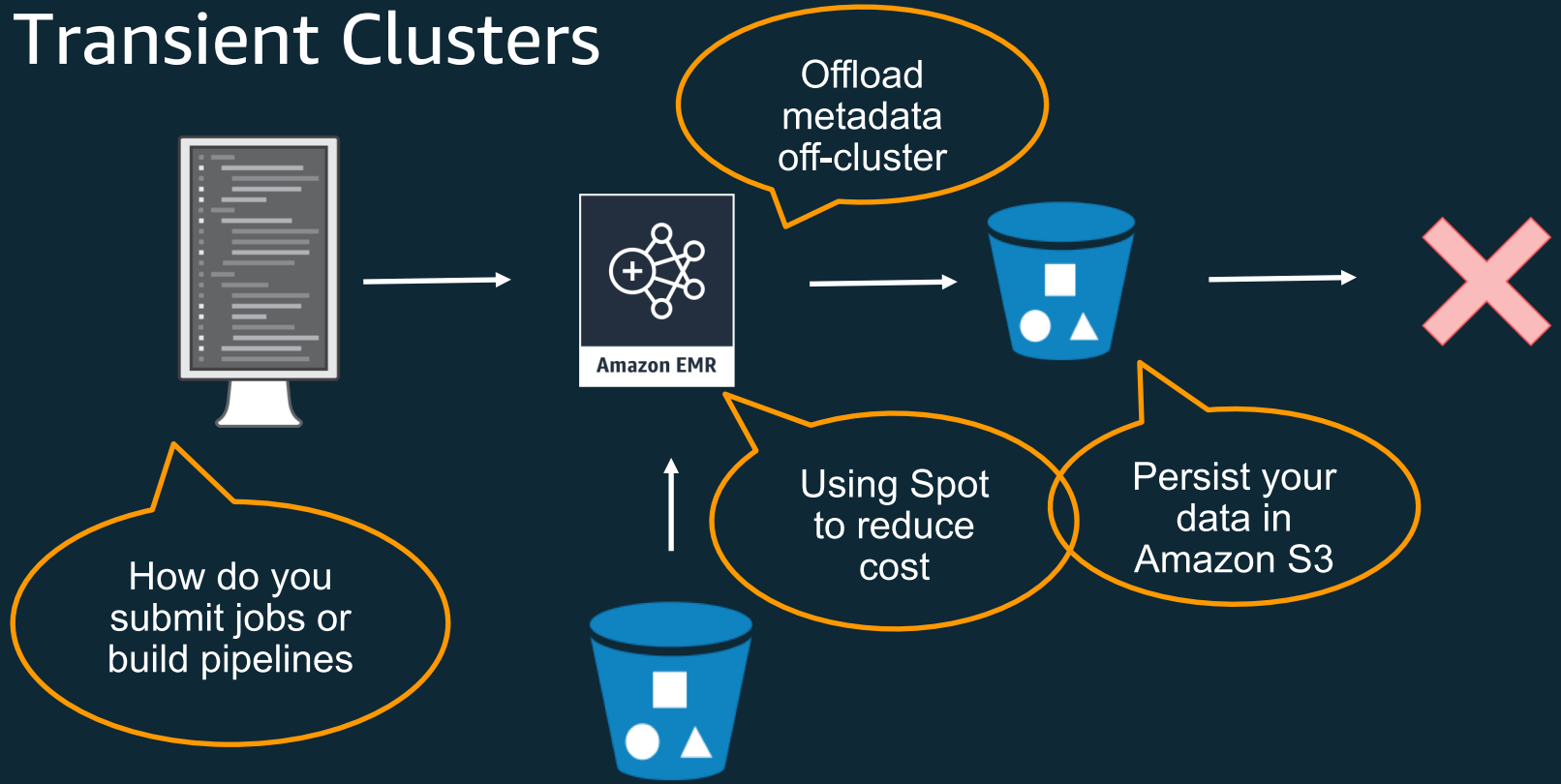
Transient Clusters



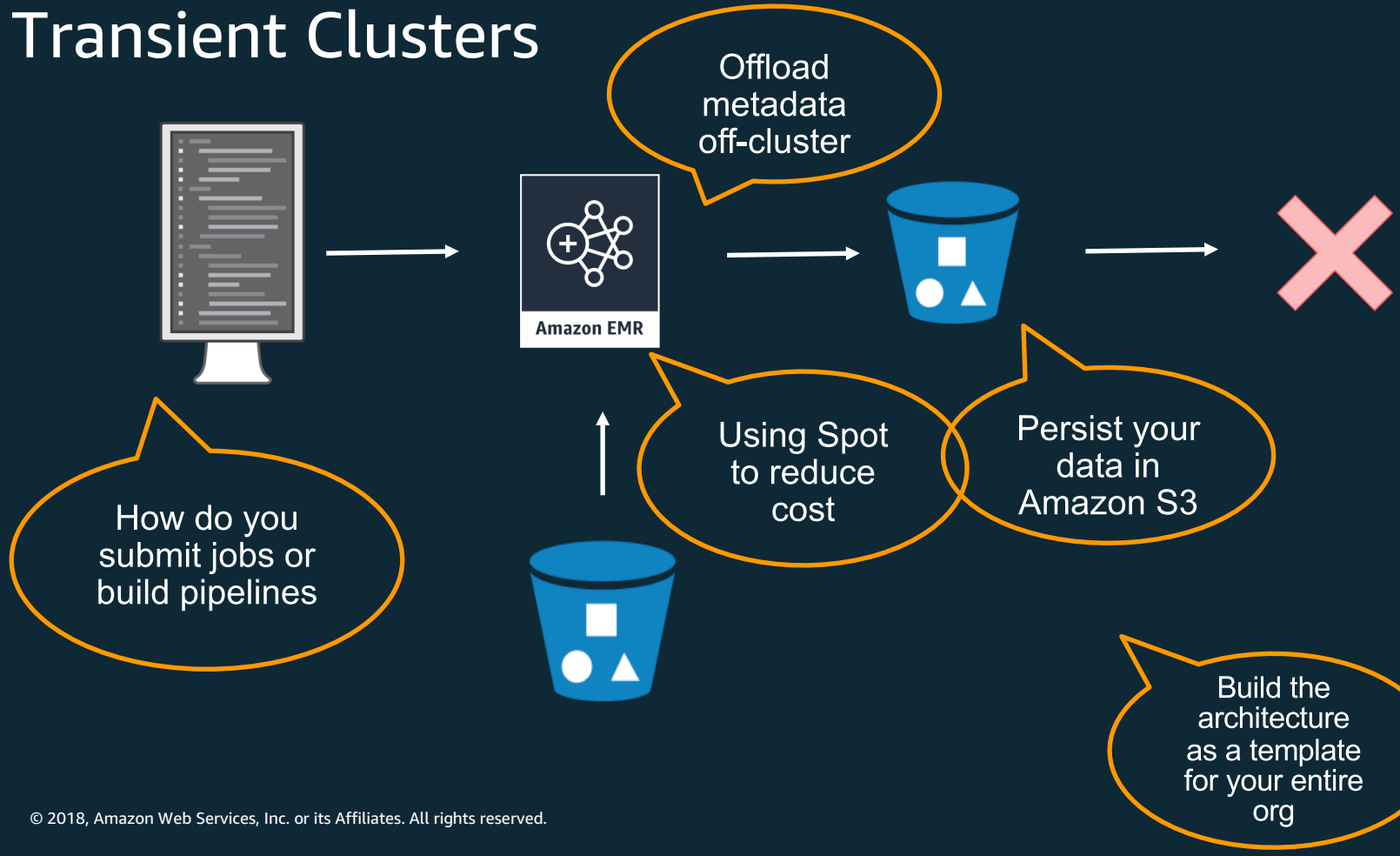
Transient Clusters



Transient Clusters

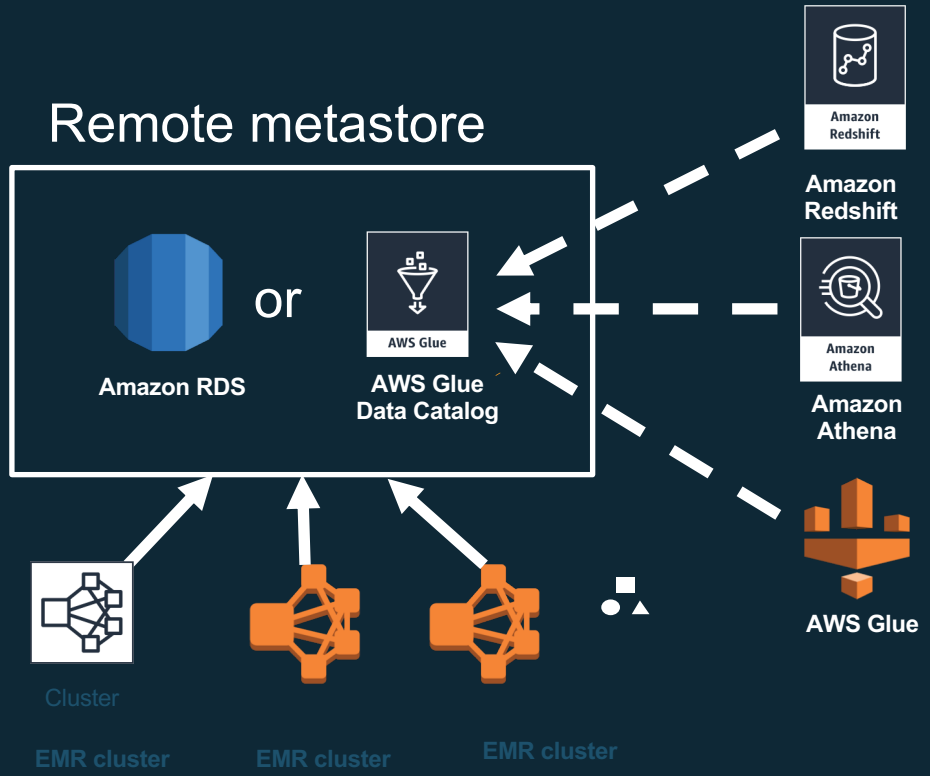


Transient Clusters

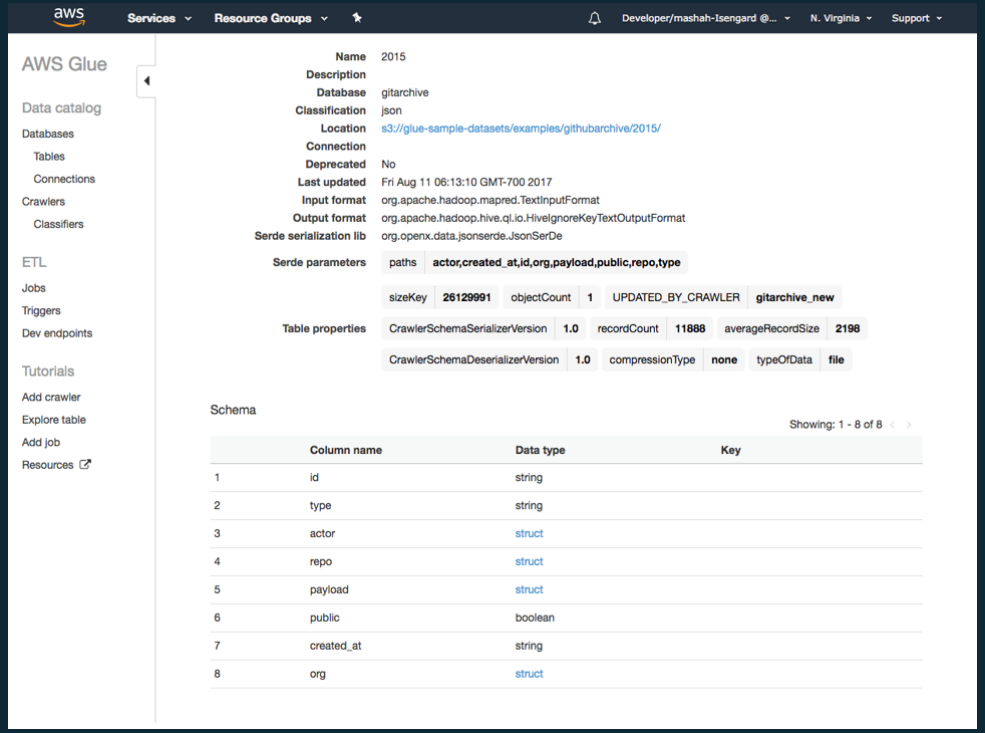


Run Stateless

- Maintain metastores off cluster
- Faster startup time lowers cost



Use AWS Glue Data Catalog as Common Metadata Store



- Support for Spark, Hive, and Presto
- Auto-generate schema and partitions
- Managed table updates
- Fine-grained access control to databases and tables
- Cross-account data catalog access

aws

Cloud Native Patterns: Optimize Costs

aws

When to use Spot?

Cluster Configuration Guidelines:

https://docs.aws.amazon.com/emr/latest/ManagementGuide/emr-plan-instances-guidelines.html

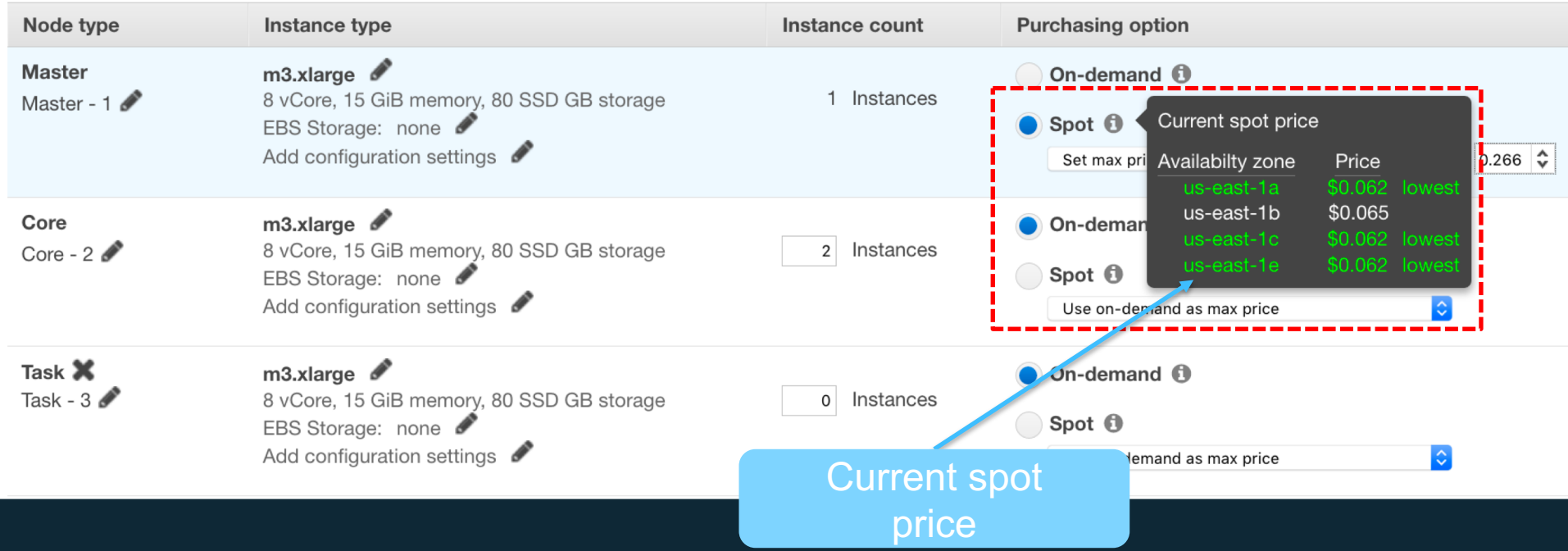
When Should You Use Spot Instances?

When you launch a cluster in Amazon EMR, you can choose to launch master, core, or task instances on Spot Instances. Because each type of instance group plays a different role in the cluster, there are implications of launching each node type on Spot Instances. You can't

Application Scenario	Master Node Purchasing Option	Core Nodes Purchasing Option	Task Nodes Purchasing Option
Long-Running Clusters and Data Warehouses	On-Demand	On-Demand or instance-fleet mix	Spot or instance-fleet mix
Cost-Driven Workloads	Spot	Spot	Spot
Data-Critical Workloads	On-Demand	On-Demand	Spot or instance-fleet mix
Application Testing	Spot	Spot	Spot

aws

Hardware Configuration – Spot Integration



Cloud Native Patterns: Automate Job Submission and Scripting

aws

Options to submit jobs

Submit a Spark application

Amazon EMR Step API

Use AWS Lambda to submit applications to EMR Step API or directly to Spark on your cluster

AWS Step Functions

AWS Data Pipeline

Create a pipeline to schedule job submission or create complex workflows

Airflow, Luigi, or other schedulers on EC2

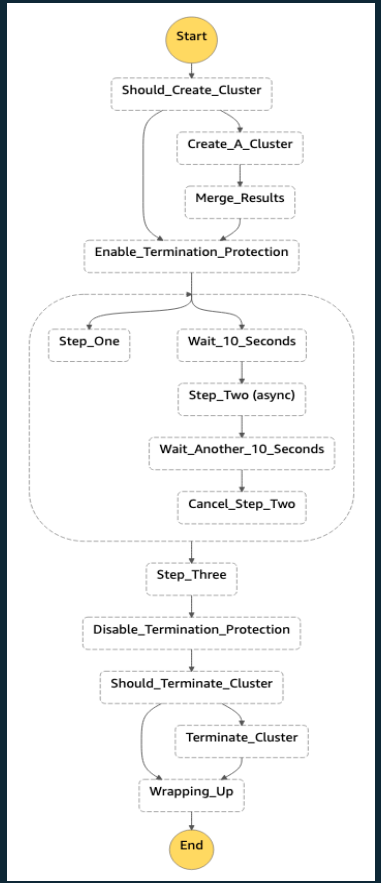
Livy Server

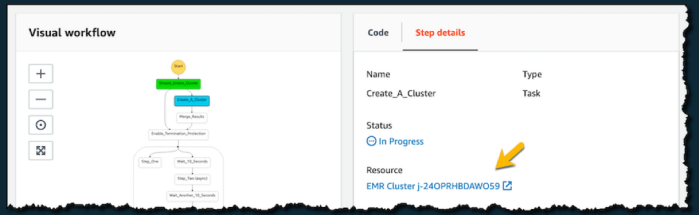
Amazon EMR

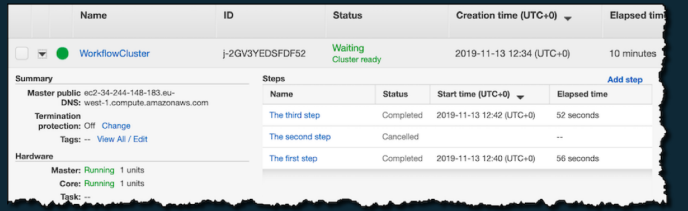
Use Oozie on your cluster to build DAGs of jobs

Automate workflows using AWS Step Functions

1. Create, scale, and modify clusters
2. Add, cancel, or run steps in parallel
3. Synchronous and asynchronous steps
4. Handle exceptions/failures
5. Scale clusters up or down
6. Reuse clusters
7. Terminate them







Cloud Native Patterns: Decouple Notebooks

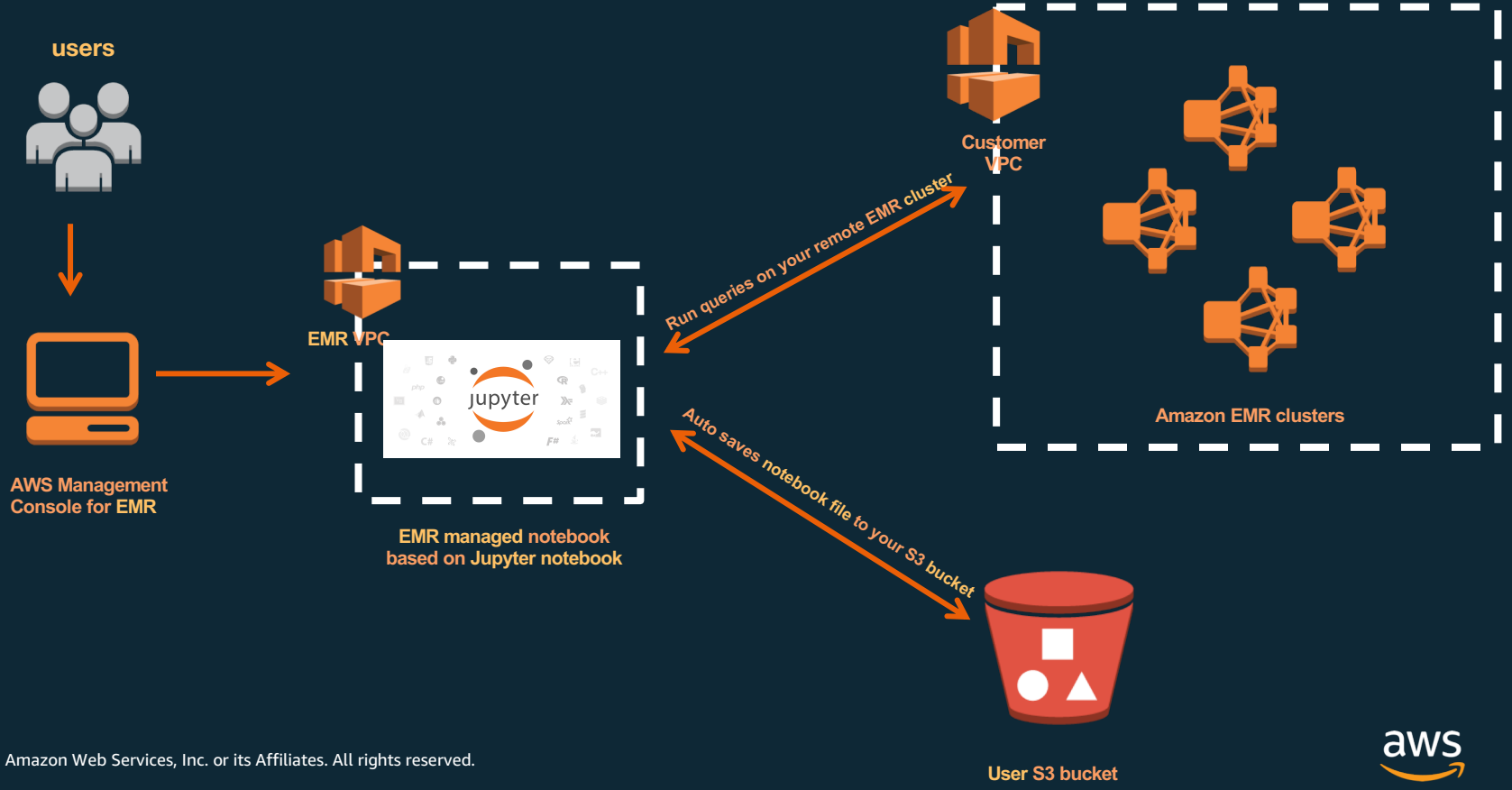
aws

EMR Notebooks

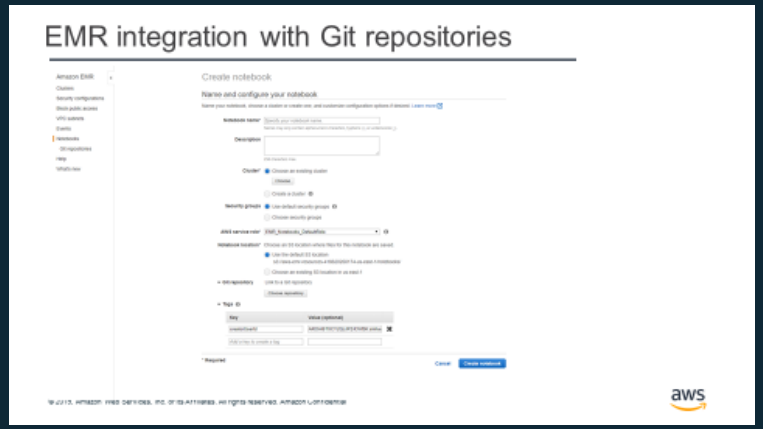
- De-couple Notebooks from Clusters
- Based on Open Source Jupyter Notebooks
- Attach to a cluster to run jobs
- Multiple users can attach to the same cluster (set Autoscaling on a cluster)
- Detach and Attach to other clusters
- Save notebooks to Amazon S3
- Tag-based permissions

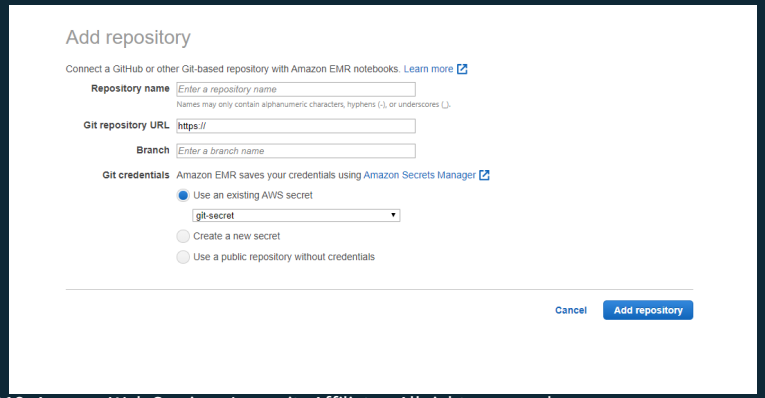
Notebooks

Off-cluster notebook based on Jupyter notebook application



Associate notebooks with repositories





- Associate notebooks with repositories
- Collaborate and share notebooks
- Integrate with pipelines
- Integration with AWS Secrets Manager

aws

Cloud Native Patterns: Template Best Practices across Organization

aws

Self-service with EMR & AWS Service Catalog

Use Case: Make it **easy** for your customers to launch EMR clusters on AWS while:

- Remove/Reduce EMR/AWS learning curve
- Reduce on-boarding time
- Ensuring Security & Standards
- Adhere to Budgets
- Integrating with Internal Processes & Approval workflows
- Integrate with best practices

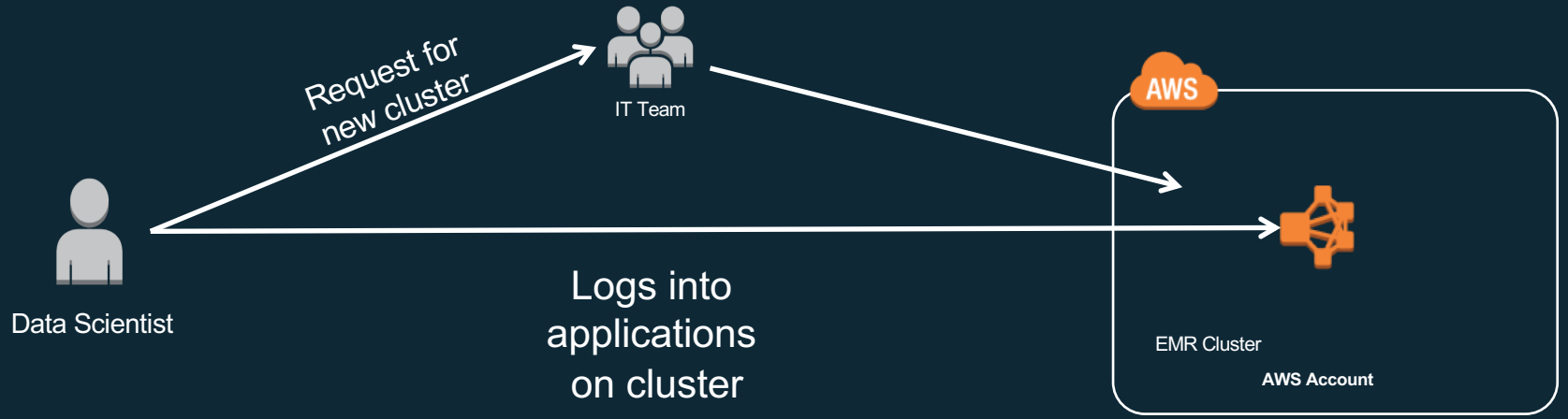
aws

EMR with AWS Service Catalog

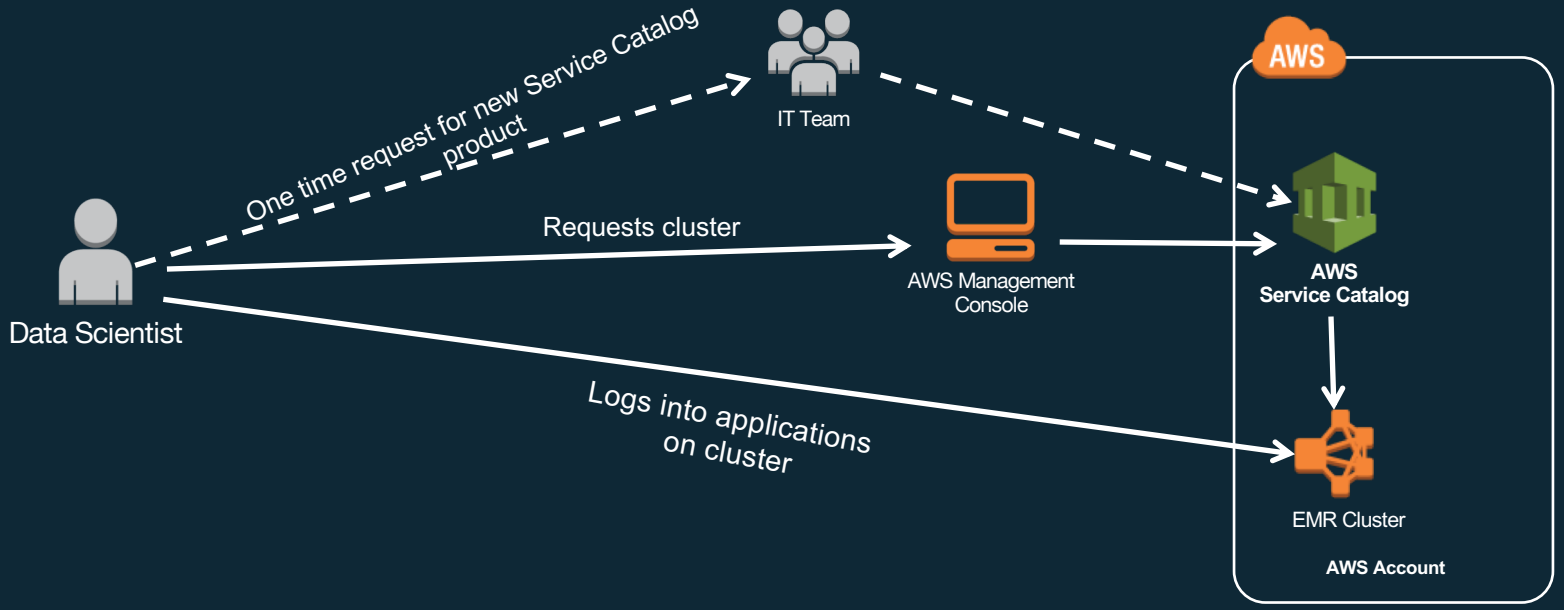
Configure		Consume	
	Standardize		Developer Autonomy
	Enforce Consistency and Compliance		One-Stop Shop
	Limit Access		Automate Deployments
	Enforce Tagging, Security Groups		Agile Governance

aws

Before: EMR Cluster Request Process



EMR Self-Service with Service Catalog (SC)



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12:45 PM – 1:00 PM. Close Out and Next Steps

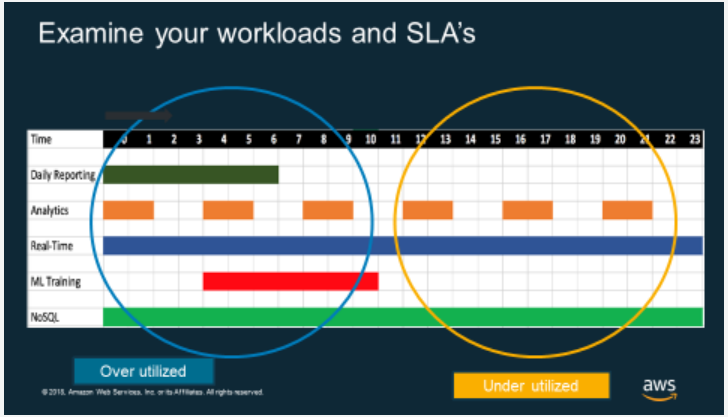
To participate in the labs, please send an email to **dbayard@amazon.com**

Wrapup

The Need for Change.
Challenges of on-premises clusters.

Summary of Challenges

1. **Fixed Cost:** Forced into entering into a multi-year commitment for HW, SW and associated Support Fees driving a sizable capital outlay.
2. **Storage / Compute:** These are tightly coupled, so even if you just want to increase storage for a data retention use case, you incur cost for unnecessary compute.
3. **Always On:** Cluster was always on, which is not resource and cost efficient. Consider the cost of power, FTE's and other data center demands.
4. **Self-Service:** Users want options to deploy only certain services such as Hive, Spark, Presto only; oftentimes just want to test a new service.
5. **Static, Not-scalable & Unused Capacity:** Always fixed number of nodes used; unable to scale based on input size of data (small data sets vs. larger data sets) and lacked consideration for cluster contention.
6. **Outages Impact:** During Production outages, no alternative means to access the cluster. Must consider the implication of downtimes.
7. **Production Upgrade:** Upgrading individual services (i.e. Hive) is laborious to run through DEV, TEST, and PROD cluster environments.
8. **Slow Deployment Cycle:** The cumulative effect of above impacts speed of readying the right infrastructure to solve business and technical use cases.



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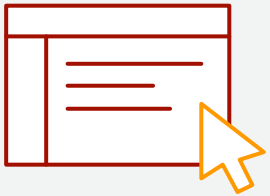
The value of cloud-based Hadoop/Spark with Amazon EMR.

Introducing Amazon EMR

Managed Hadoop and Spark in the cloud

Enterprise-grade



Easy

Lowest cost

aws

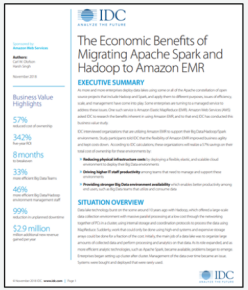
Benefits Summary

10 Benefits of migrating to Amazon EMR

1. Decoupled Compute & Storage
2. Built-in Disaster Recovery
3. Turn off your clusters through Transient clusters
4. Agility of Auto-scaling Persistent clusters
5. Leverage Spot pricing for unused EC2 capacity
6. Self-service with AWS Service Catalog
7. Spark Performance Improvements
8. Fully Managed EMR Notebooks
9. Lowest TCO in the Industry, analysts confirm
10. EMR is surrounded by the industry's broadest Analytics ecosystem

Nov. 2018, **IDC** report confirms:

"EMR provides 57% reduced costs vs. on premise resulting in 342% ROI over 5 years."


IDC

The Economic Benefits of Migrating Apache Spark and Hadoop to Amazon EMR

EXECUTIVE SUMMARY

Business Value Highlights

57%

342%

8 months

33%

46%

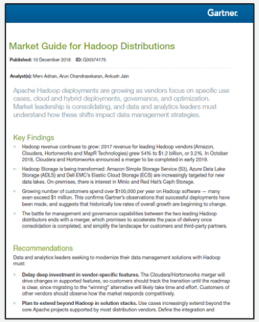
99%

$2.9 million

SITUATION OVERVIEW

Dec. 2018, **Gartner** suggests:

"AWS remains the largest Hadoop provider in terms of both revenue and user base."


Gartner

Market Guide for Hadoop Distributions

Key Findings

Recommendations

Feb. 2019, **Forrester** recognizes:

AWS EMR as the Cloud Hadoop/Spark (HARK) Leader

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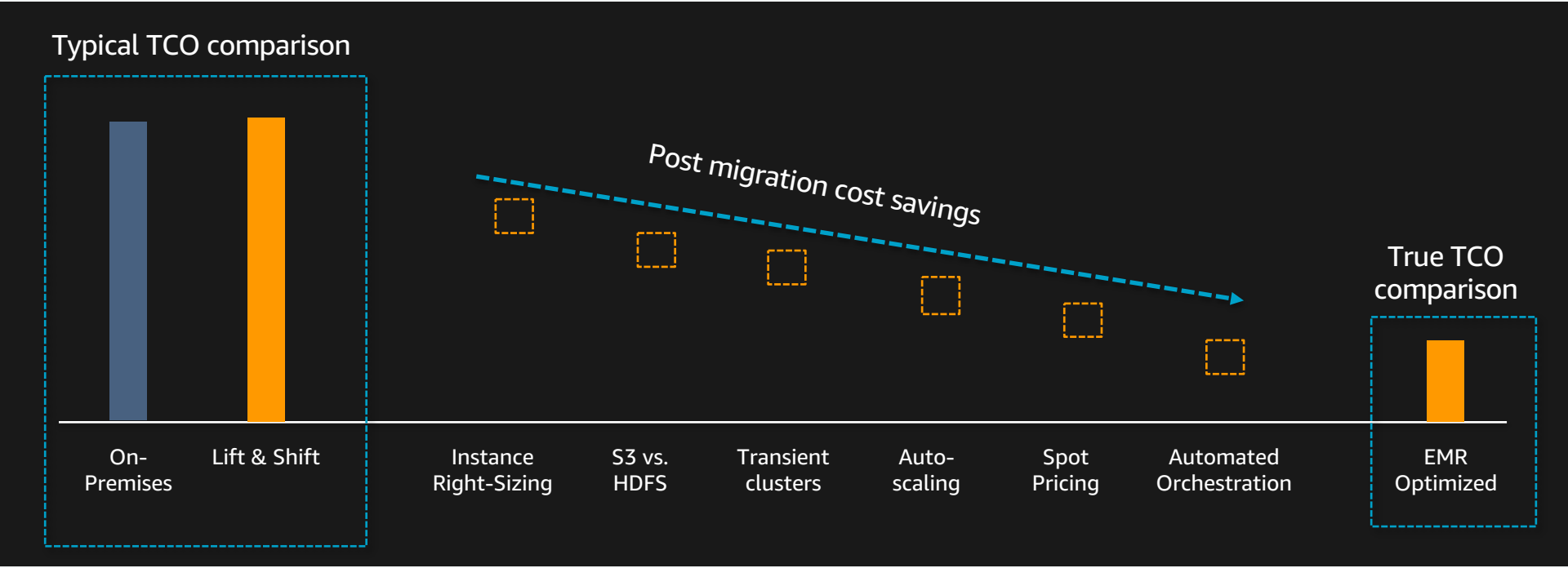
EMR Design Options

Transient vs. Persistent Cluster
Amazon S3 vs. local HDFS
Elastic Cluster vs. Static Cluster
On-Demand vs. Reserved vs. Spot
Core Nodes vs. Task Nodes

A multi-phased approach to best practice deployment

Go beyond a lift & shift to optimize for scale and cost.



Resources

Service page
https://aws.amazon.com/emr

Getting started
https://aws.amazon.com/emr/getting-started/

EMR Migration Program
https://aws.amazon.com/emr/emr-migration

AWS Big Data Blog
https://aws.amazon.com/blogs/big-data/