Big Data Analytics made simple and easy with Amazon EMR

Easily scale and query with Apache Spark, Hive, Presto, and others

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Trends and challenges in Big Data

Customers want more value from data

Growing Exponentially

From new sources

Increasingly diverse

Used by people with diverse skillsets

Accessed by many applications

Self managing analytics services is time consuming, complex, and expensive

Non Scalable Infrastructure

On-premise big data deployments are complex to install, manage and scale.

High Cost

Advanced features such as centralized data catalog, handling streaming data need to be licensed separately.

Lock in

Data stored can only be consumed by the proprietary platform and needs to be duplicated to extend it to other tools.

What is Amazon EMR and how do customers use it?

Amazon EMR

Big Data analytics using open-source frameworks: Apache Spark, Presto, Trino, Hive, HBase, Hudi and Flink

Differentiated performance for Runtimes

Performance optimized runtime for popular frameworks like Spark, Hive, Presto, and Flink with 100% open source API compatibility

Latest open source features

New open source features available within 30-60 days of release in open source

Best price performance for big data analytics

Reduce cost using EC2 Spot, EMR Managed Scaling and per-second billing

Self service data science

Data Science IDE with EMR Studio and Deep integration with Sagemaker Studio provides ability to use open source UX and frameworks to build, visualize and debug applications

Multiple deployment models

EMR provides flexibility to run big data workloads on EC2, EKS, EMR Serverless, and on-premises with Outpost

S3 Data Lake Integration

Fine grained access controls with AWS Lake Formation and Apache Ranger, and Integrations with Apache HUDI, Apache Iceberg, and Delta Lake to enable S3 data lake use cases

Why do customers use **Amazon EMR?**

To build Data Lakes as part of modern data architecture for scalable data analysis

To query petabytes of data both in batch and real-time using Apache Spark, Hive, and Presto

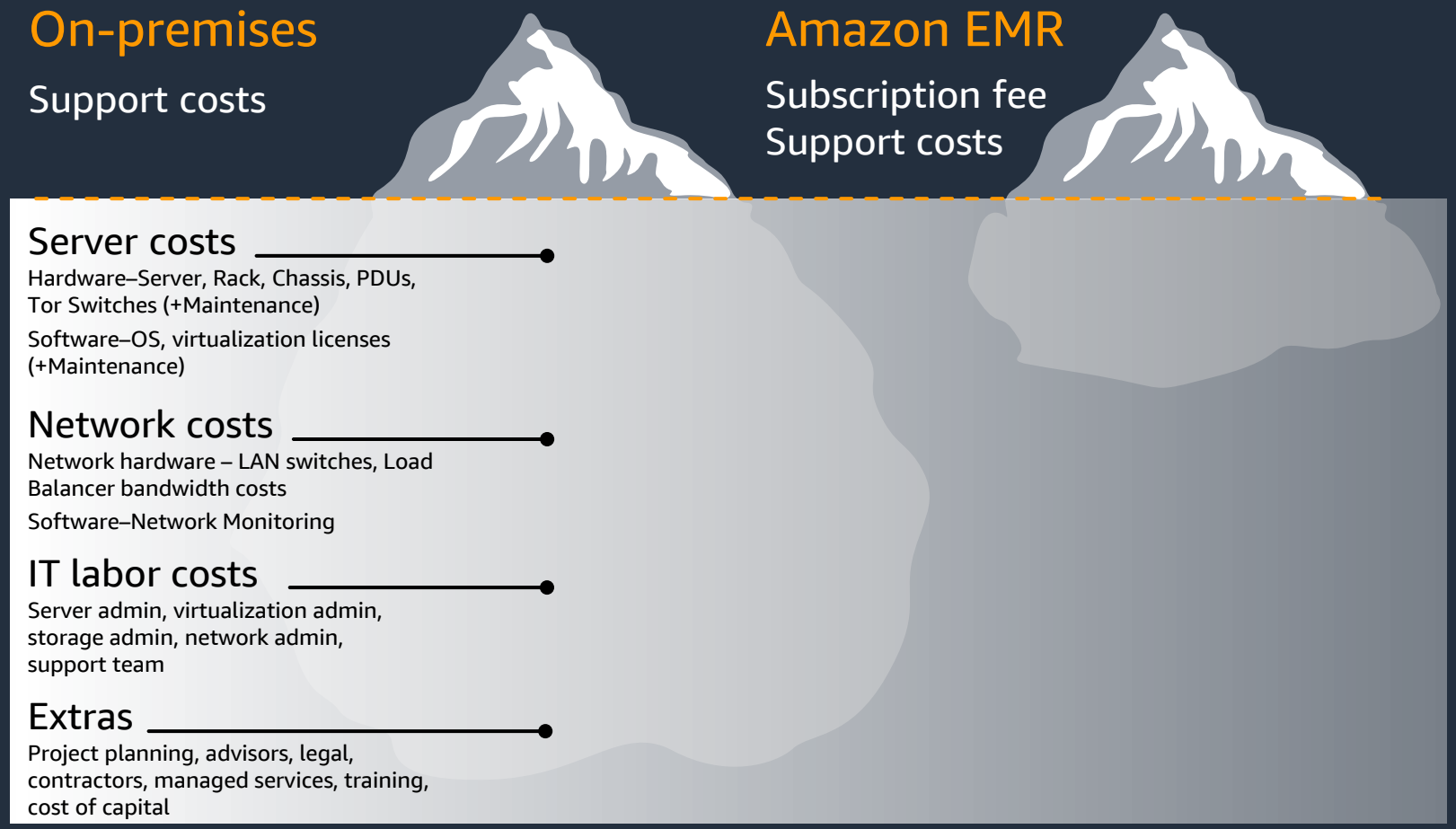
To migrate from expensive Big Data solutions to reduce costs and gain flexibility

To gain insights using BI tools and prepare data for Machine Learning

To build big data applications using Notebooks and leverage other AWS Analytics services

Lower costs with Amazon EMR

LOWER TCO



- Less admin time to manage, and support Hadoop clusters
- No up-front costs – hardware acquisition, installation
- Save on operating costs – data center space, power, cooling
- Business value: Cost of delays, risk premium, competitive abilities, governance, etc.

High impact results with Amazon EMR

EPIC GAMES FORTNITE	near real-time analytics for 250M 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

Challenge:

FINRA's legacy system was not able to scale to handle 150 billion events per day. They needed to run complex surveillance queries over 20+ PB of data to detect and analyze illegal market activity

Solution:

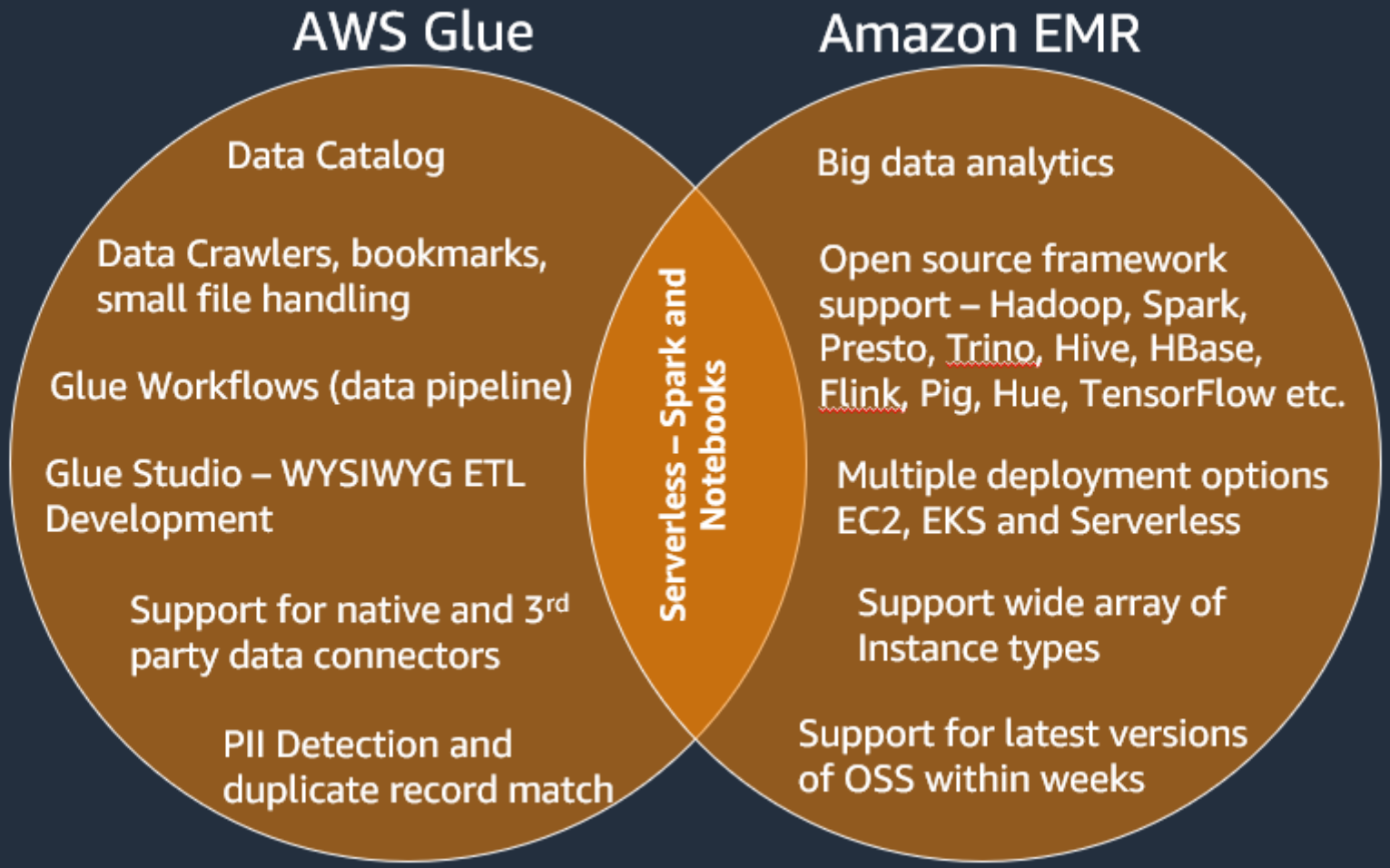
FINRA migrated their big data appliance to a S3 Data Lake and uses Lambda and EMR for data ingestion and EMR and Redshift for data processing

Result:

FINRA has been able to increase agility, speed, and cost savings while allowing them to operate at scale. The company estimates it will save $10 to $20 million annually by using AWS

Glue Vs. EMR

Data Integration and ETL on AWS



What's New in Amazon EMR

Capabilities available to reduce costs

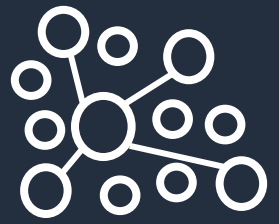
With EMR, you can do way more with way less!

Performance optimizations

- Runtime improvements
- Transactions in data lakes

Compute optimizations

- Graviton instances
- Spot instances
- Instance fleets



Cluster management

- Managed Scaling
- Cluster auto-termination

Amazon EMR innovates constantly in these areas

Cost & Performance

Ease of use

Transactional Data lakes

Security

Differentiated Spark runtime performance

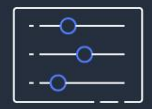
Over 3X faster than standard Apache Spark 3.0 in Derived TPC-DS 3TB benchmark

Takes advantage of AWS native Graviton2 instances to provide the best performance

100% compliance with open source APIs makes moving applications to EMR easy

Performance improvements are enabled by default

Dynamic Sized Executors



Adaptive Join Selection

Dynamic Pruning of Data Columns

Operator Optimization

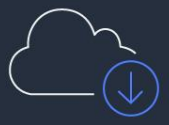
Early Worker Allocation

Intelligent Filtering

Parallel/Async Initialization

Redundant Scan Elimination

Data Pre-Fetch



Broadcast Join w/o Statistics

Stats Inference

Optimized Metadata Fetch

Managed Scaling feature overview

Automatically reduce cost by 60% shaping cluster size

Constantly improving EMR managed algorithm that gives you a fully managed experience

High Resolution Metrics enabled with Managed scaling

Only min/max cost constraints configurations required

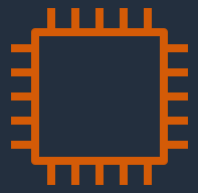
More data points and faster reaction time than autoscaling

Save 20-60% costs

Improvements in cluster startup times

Starting or scaling an EMR on EC2 cluster is now 35% faster

Task nodes provisioned alongside core and master nodes



Have ready to use proxy instances available to improve start time for cluster launched in private subnet

Optimized retry policies for EC2 throttling

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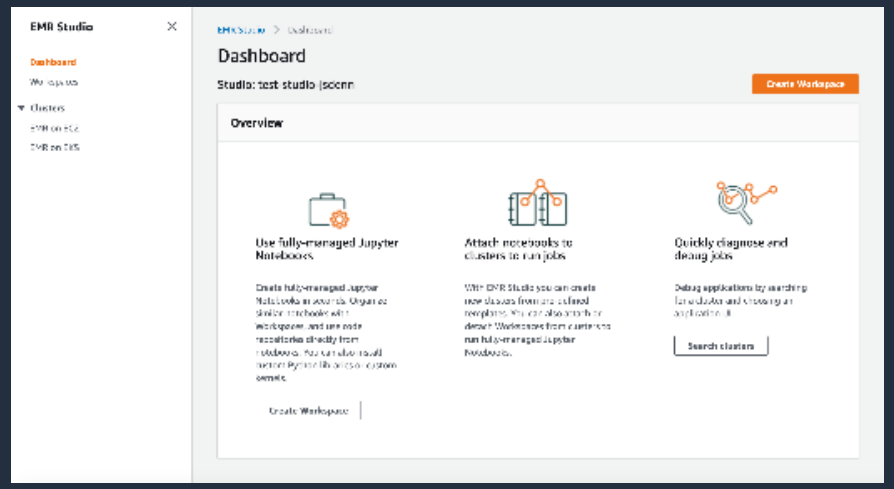
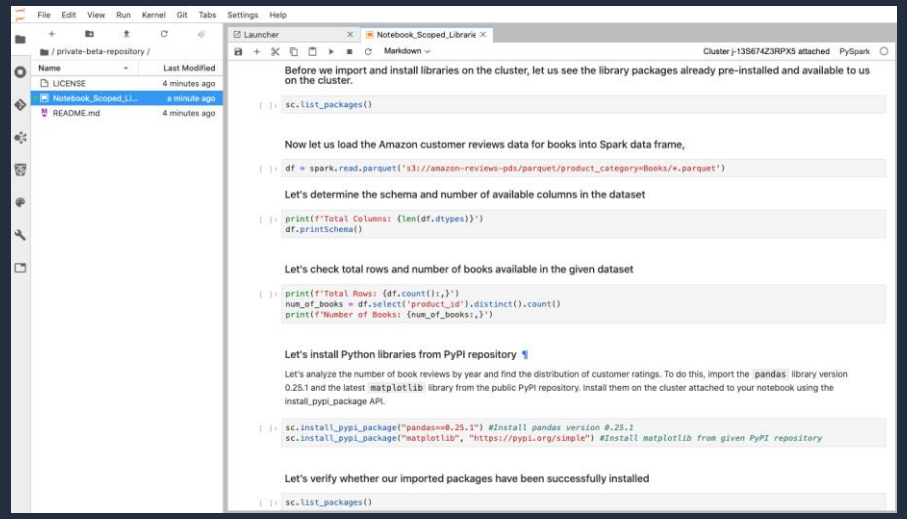
EMR Studio

FULLY MANAGED IDE FOR INTERACTIVE DATA ANALYTICS: DEVELOP, VISUALIZE, AND DEBUG APPLICATIONS





Single sign-on integration with IdP

Fully-managed Jupyter Notebooks

Integrated with Git Repositories

Simplified debugging with Spark UI and YARN UI

Browse, create, or delete EMR clusters

Run Notebooks in workflows using APIs

Run interactive data analysis using EMR on EKS clusters

NEW!

EMR Studio features

FULLY MANAGED IDE FOR INTERACTIVE DATA ANALYTICS: DEVELOP, VISUALIZE, AND DEBUG APPLICATIONS

IAM authentication and federation support

Multi-language support (R, PySpark, Scala, SQL)

Auto-terminate idle clusters

Real-time co-authoring of notebooks

SQL explorer with Presto support

Mount workspace directories to EMR clusters

Latest JupyterLab, JEG, Livy, SparkMagic

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Transactional Data lakes

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Transactional data lakes

CHOICE OF FRAMEWORK FOR EACH WORKLOAD

EMR 6.9 includes:

Apache Hudi 0.12

Apache Iceberg 0.14.1

OSS Delta Lake 2.1.0

Transactional data lakes features

TRANSACTIONS, RECORD-LEVEL UPDATES/DELETES, AND CHANGE STREAMS TO DATA LAKES

Ingestion

- Transactions (ACID) - Reader and writer isolation
- Transactions (ACID) - Concurrent write support
- Record level upserts and deletes
- High throughput streaming ingestion
- Spark, Flink, and Java Writer Support
- Automatic compaction of small files
- SQL DML support

Query

- Spark, PrestoDB/Trino, Flink, Hive Support
- Efficient queries across partitions and files
- Incremental query support
- Time travel query support

Transactional data lakes features

TRANSACTIONS, RECORD-LEVEL UPDATES/DELETES AND CHANGE STREAMS TO DATA LAKES!

Administration

- Async background compaction of files
- Async background sorting and clustering of keys
- Automatically clean up files beyond retention period
- Metrics for past commits or rollbacks

Apache Hudi

RICH PLATFORM TO BUILD STREAMING DATA LAKES WITH INCREMENTAL DATA PIPELINES

Apache Hudi 0.12

EMR 6.9 includes Hudi 0.12.

Key new features include:

- Multi-modal indexes: Improve the lookup performance in file index and query latency with data skipping
- Async indexer service: Index columns in the background without affecting writes
- Schema-on-read for Spark: Improved Schema evolution support

NEW!

Apache Iceberg

OPEN TABLE FORMAT FOR HUGE ANALYTIC DATASETS

Apache Iceberg 0.14.1 is packaged as a library for Spark3 Runtime, Trino, Flink, and Hive in EMR 6.9.0.

Key new features include:

Apache Iceberg

- Time travel support with Spark SQL and Trino SQL
- Merge on Read (MoR) support
- Optimistic concurrency with AWS Glue Data Catalog
- Disaster recovery with S3 access points
- Flink and Hive integration (EMR 6.9.0)

NEW!

OSS Delta Lake

OPEN-SOURCE STORAGE FRAMEWORK THAT ENABLES BUILDING A LAKEHOUSE ARCHITECTURE

OSS Delta Lake 2.1.0

OSS Delta Lake 2.1.0 is packaged as a library in EMR 6.9.0.

Engines supported : Spark3 and Trino

To learn more :

https://docs.aws.amazon.com/emr/latest/ReleaseGuide/emr-delta.html

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Cost & Performance

Ease of use

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Security

Security pillars

Isolation

Authentication

Authorization

Encryption

Audit

- VPC
- Private subnets
- Security groups

- LDAP
- Kerberos
- AWS IAM Identity Center (EMR Studio)
- AWS IAM (EMR Studio)

- Cluster IAM Role
- FGAC using Apache Ranger
- FGAC using AWS Lake Formation NEW!
- Job runtime role NEW!

- Encrpytion at rest
- Encrpytion in transit

- Audit using Ranger
- Audit using AWS Lake Formation NEW!

Amazon EMR Deployment Options

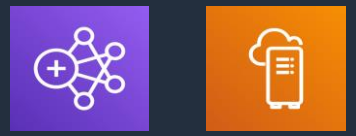
EMR Deployment Options

Amazon EMR on Amazon EC2

Choose instances that offer the best price performance for your workload

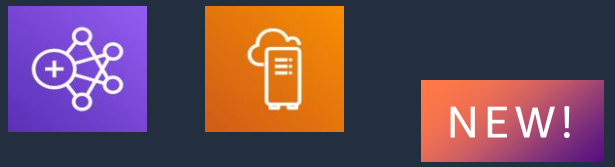
Amazon EMR on Amazon EKS

Automate provisioning, management, and scaling of Apache Spark jobs on EKS



Amazon EMR on AWS Outposts

Set up, manage, and scale EMR in your on-premises environments, just as you would in the cloud



Amazon EMR Serverless

Run petabyte-scale data analytics in the cloud without managing and operating clusters

Amazon EMR Serverless

All the benefits of EMR without managing clusters and servers

Run frameworks more easily; just pick a version and run

Automatically scale; don't guess cluster sizes

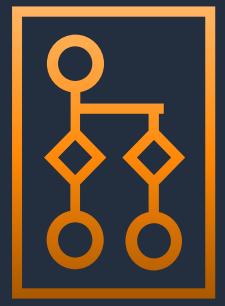
Optimize cost; Automatic and fine-grained scaling reduces cost

Performance-optimized version delivers 2x better performance

Multi-AZ resiliency from day 1

Integration with familiar tools like Apache Airflow

Jobs



Run jobs on applications

Can run multiple jobs on an application

Can control authorization using per-job execution role

Workers

Internally used to execute your workloads

Workers run the OSS framework you choose

You can change the size of workers to control performance

Pre-initialized workers

Optional feature to pre-initialize workers

Jobs start immediately

Helps you maintain a warm pool

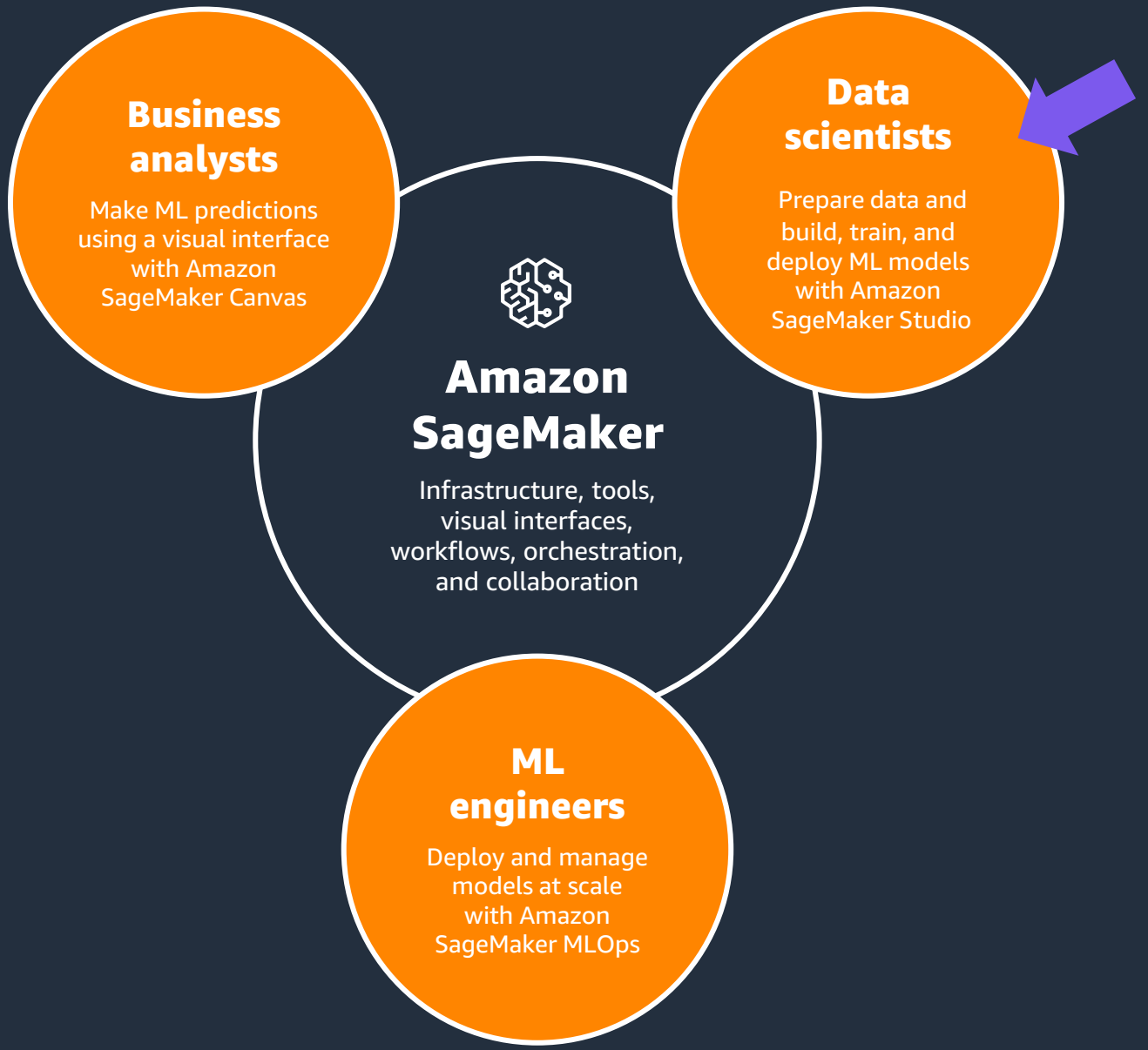
	AWS Glue	Amazon EMR Serverless	Amazon EMR on EC2	Amazon EMR on EKS
Serverless	Yes (Acquires capacity for jobs at launch)	Yes (Virtual cluster model, with pre-initialized capacity)	No	No (Yes if Fargate but still Kubernetes expertise required)
Frameworks	Spark and Python	Spark, Hive, Trino (coming soon)	Spark, Hive, Trino, Hbase, Flink, …	Spark
Pricing unit of measure	DPUs (4vCPU/16GB)	Workers aggregated consumed resources (aggregated vCPU, memory, storage)	EC2 instances + EMR price (per instance) + EBS	[EC2 instances + EBS] or [fargate] + EKS price (per cluster)
Startup time	~10 seconds	~2 minutes OR ~few seconds if pre-initialized capacity	~5 minutes with only Spark installed (no kerberos) (this considers the time to create the cluster as subsequent jobs submissions are almost immediate)	~10 seconds if EKS instances available OR ~2 minutes if 0 nodes available OR ~2 minutes if Fargate
Scaling	Fully managed (both for batch and streaming)	Fully managed	Autoscaling with custom policies (Cloudwatch metrics based) OR Managed scaling (only YARN based applications, fully-managed)	EKS auto-scaler / Karpenter OR Serverless with Fargate
Interactive Analysis	Glue interactive sessions, Glue Studio, Glue Notebooks, SageMaker Studio and desktop-based Notebooks	EMR Studio	Jupyterhub, Hue, Zeppelin, EMR Studio, SageMaker Studio and desktop-based Notebooks	EMR Studio and desktop-based Notebooks

Amazon Sagemaker + Amazon EMR

+

Amazon SageMaker **Amazon EMR**

Amazon SageMaker helps organizations harness ML



Amazon SageMaker Studio Notebook + EMR

Discover, connect to, create and terminate EMR clusters (Hive, Spark and Presto)

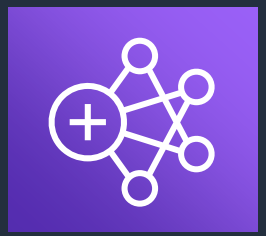
Collaborate using Scala-based Spark and PySpark notebook kernels

Bring your own image and customize notebook lifecycle configuration

Enforce fine-grained data access

Automate EMR, Glue and ML pipelines in production

SageMaker Studio Notebook



EMR

SageMaker

Lake Formation (Governance)

Thank you

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