# EMR Cluster Creation

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aws

# Creation Options

AWS Management Console

AWS CLI

AWS SDKs

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## Compute
EC2
Lightsail
ECR
ECS
EKS
Lambda
Batch
Elastic Beanstalk
Serverless Application Repository

## Storage
S3
EFS
FSx
S3 Glacier
Storage Gateway
AWS Backup

## Database
RDS
DynamoDB

## Robotics
AWS RoboMaker

## Blockchain
Amazon Managed Blockchain

## Satellite
Ground Station

## Management & Governance
AWS Organizations
CloudWatch
AWS Auto Scaling
CloudFormation
CloudTrail
Config
OpsWorks
Service Catalog
Systems Manager
Trusted Advisor
Managed Services

## Analytics
Athena
EMR
CloudSearch
Elasticsearch Service
Kinesis
QuickSight
Data Pipeline
AWS Glue
MSK

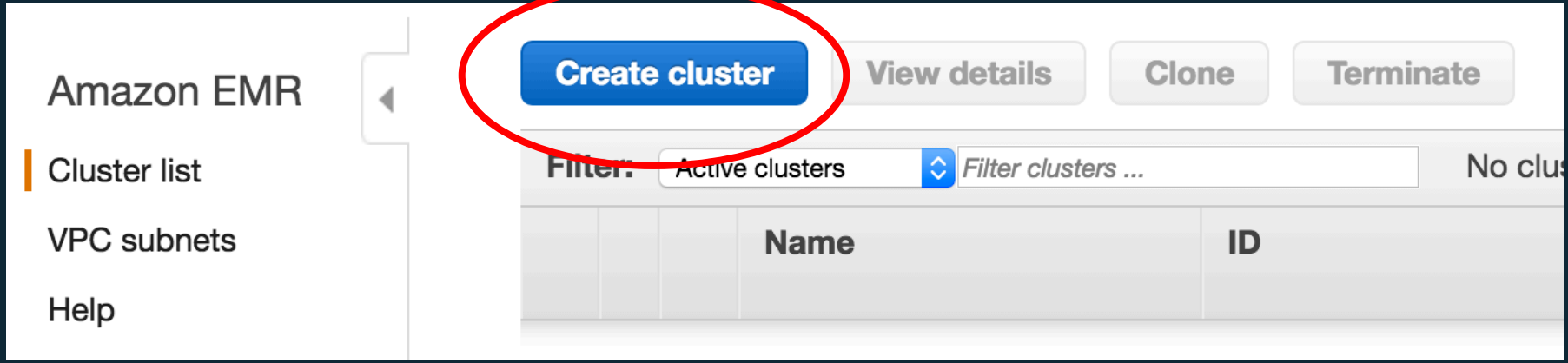
## Security, Identity, & Compliance
IAM
Resource Access Manager
Cognito
Secrets Manager
GuardDuty
Inspector
Amazon Macie
AWS Single Sign-On
Certificate Manager
Key Management Service
CloudHSM

## Business Applications
Alexa for Business
Amazon Chime
WorkMail

## End User Computing
WorkSpaces
AppStream 2.0
WorkDocs
WorkLink

## Internet Of Things
IoT Core
Amazon FreeRTOS
IoT 1-Click
IoT Analytics
IoT Device Defender
IoT Device Management
IoT Events
IoT Greengrass
IoT SiteWise
IoT Things Graph

# Create Cluster – Console

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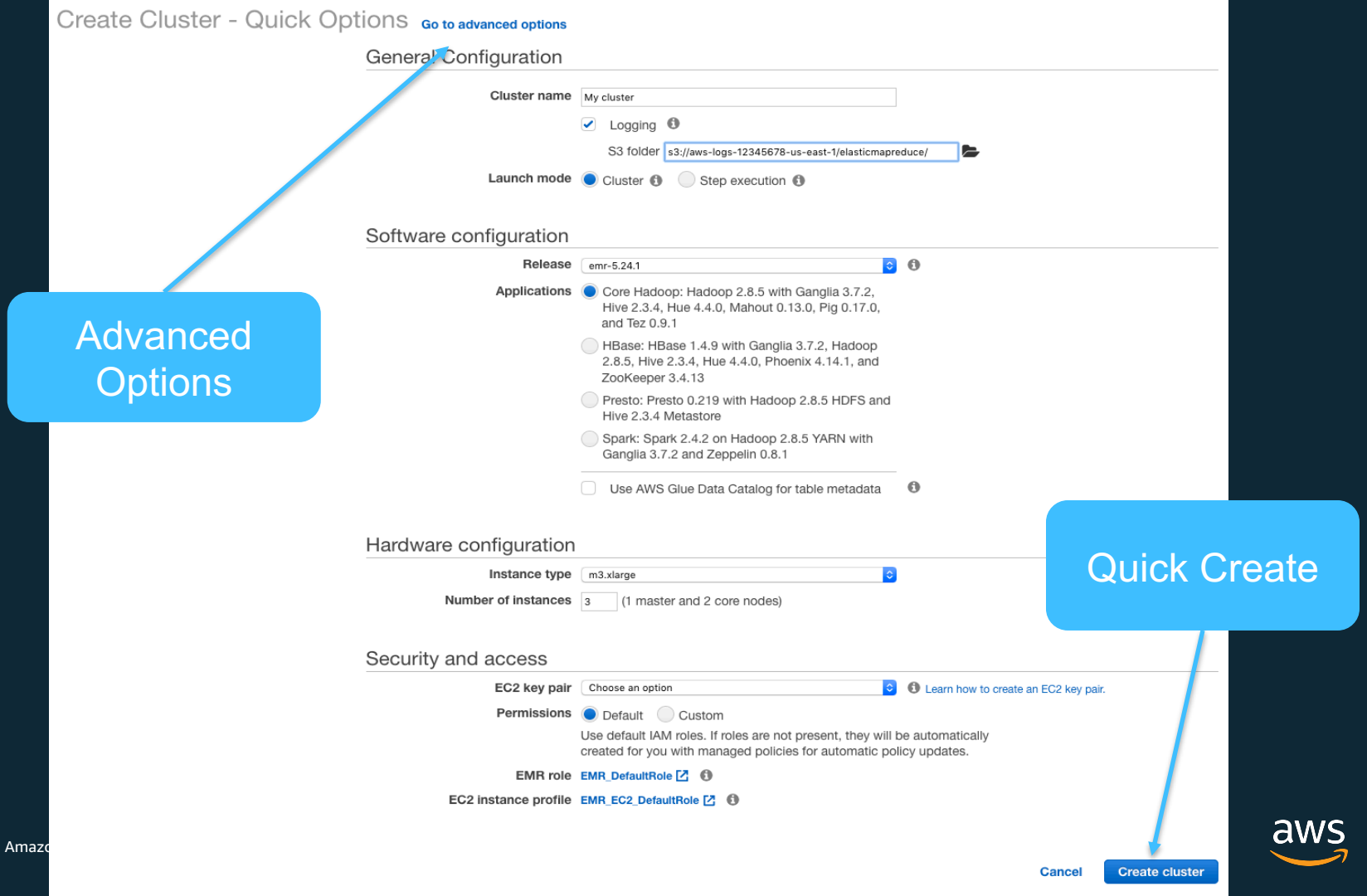
Create Cluster - Quick Options
Go to advanced options
General Configuration
Cluster name
My cluster
Logging
S3 folder
s3://aws-logs-12345678-us-east-1/elasticmapreduce/
Launch mode
Cluster
Step execution
Software configuration
Release
emr-5.24.1
Applications
Core Hadoop: Hadoop 2.8.5 with Ganglia 3.7.2, Hive 2.3.4, Hue 4.4.0, Mahout 0.13.0, Pig 0.17.0, and Tez 0.9.1
HBase: HBase 1.4.9 with Ganglia 3.7.2, Hadoop 2.8.5, Hive 2.3.4, Hue 4.4.0, Phoenix 4.14.1, and ZooKeeper 3.4.13
Presto: Presto 0.219 with Hadoop 2.8.5 HDFS and Hive 2.3.4 Metastore
Spark: Spark 2.4.2 on Hadoop 2.8.5 YARN with Ganglia 3.7.2 and Zeppelin 0.8.1
Use AWS Glue Data Catalog for table metadata
Hardware configuration
Instance type
m3.xlarge
Number of instances
3
(1 master and 2 core nodes)
Security and access
EC2 key pair
Choose an option
Learn how to create an EC2 key pair.
Permissions
Default
Custom
Use default IAM roles. If roles are not present, they will be automatically created for you with managed policies for automatic policy updates.
EMR role
EMR_DefaultRole
EC2 instance profile
EMR_EC2_DefaultRole
Cancel
Create cluster
Advanced Options
Quick Create

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# 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 |
| ☐ MXNet 1.4.0 | ☐ Sqoop 1.4.7 | ☐ Mahout 0.13.0 |
| ☑ 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

# Create Cluster - Advanced Options

Go to quick options

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

## Software Configuration

**Release** emr-5.24.1

| | | |
|---|---|---|
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| ☐ JupyterHub 0.9.6 | ☐ Tez 0.9.1 | ☐ Flink 1.8.0 |
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### 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

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# Create Cluster - Advanced Options

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- **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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| ☑ 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
☐ 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

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# 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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| ☐ Ganglia 3.7.2 | ☐ HBase 1.4.9 | ☑ Pig 0.17.0 |
| ☑ Hive 2.3.4 | ☐ Presto 0.219 | ☐ ZooKeeper 3.4.13 |
| ☐ MXNet 1.4.0 | ☐ Sqoop 1.4.7 | ☐ Mahout 0.13.0 |
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| ☐ 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

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

## Add steps (optional)

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☐ Auto-terminate cluster after the last step is completed

Cancel Next

# Create Cluster - Advanced Options

Go to quick options

- **Step 1: Software and Steps**
- Step 2: Hardware
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## Software Configuration

**Release** emr-5.24.1

| | | |
|---|---|---|
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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

☐ 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)

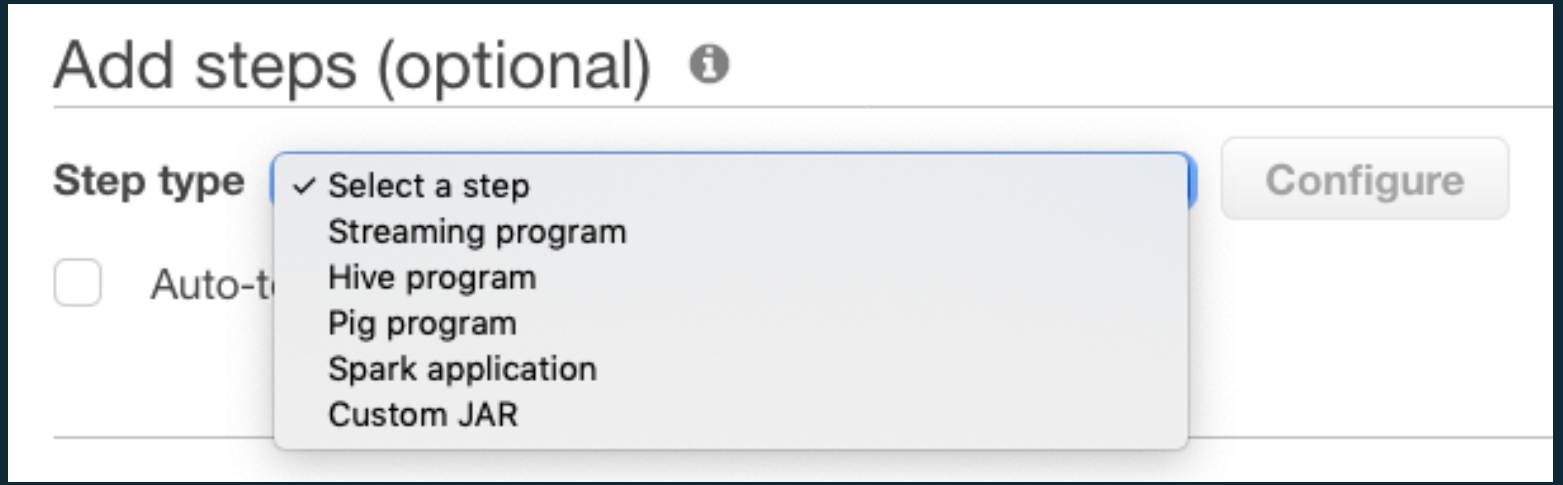
**Step type** Select a step — Configure

☐ 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

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# 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

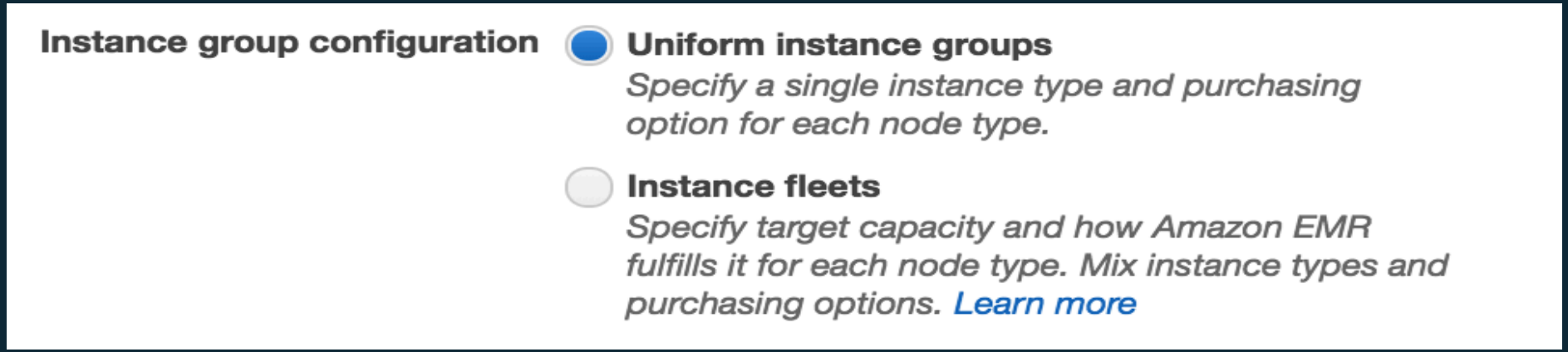
**Root device EBS volume size** 10 GiB

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**<br>Master - 1 | **m3.xlarge**<br>8 vCore, 15 GiB memory, 80 SSD GB storage<br>EBS Storage: none<br>Add configuration settings | 1 Instances | **On-demand**<br>**Spot**<br>Use on-demand as max price | Not available for Master |
| **Core**<br>Core - 2 | **m3.xlarge**<br>8 vCore, 15 GiB memory, 80 SSD GB storage<br>EBS Storage: none<br>Add configuration settings | 2 Instances | **On-demand**<br>**Spot**<br>Use on-demand as max price | Not enabled |
| **Task**<br>Task - 3 | **m3.xlarge**<br>8 vCore, 15 GiB memory, 80 SSD GB storage<br>EBS Storage: none<br>Add configuration settings | 0 Instances | **On-demand**<br>**Spot**<br>Use on-demand as max price | Not enabled |

# Instance Group Configuration – Instance fleets

- Provision from a list of instance types with Spot and On-Demand
- Launch in the most optimal Availability Zone based on capacity/price
- Spot block support



## 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*

Networking – VPC & Subnets

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

**EC2 Subnet**
subnet-a0a8089d | Default in us-east-1e
subnet-aad933dc | Default in us-east-1b
subnet-bbc55ab7 | Default in us-east-1f
subnet-d90d9ebc | Default in us-east-1d

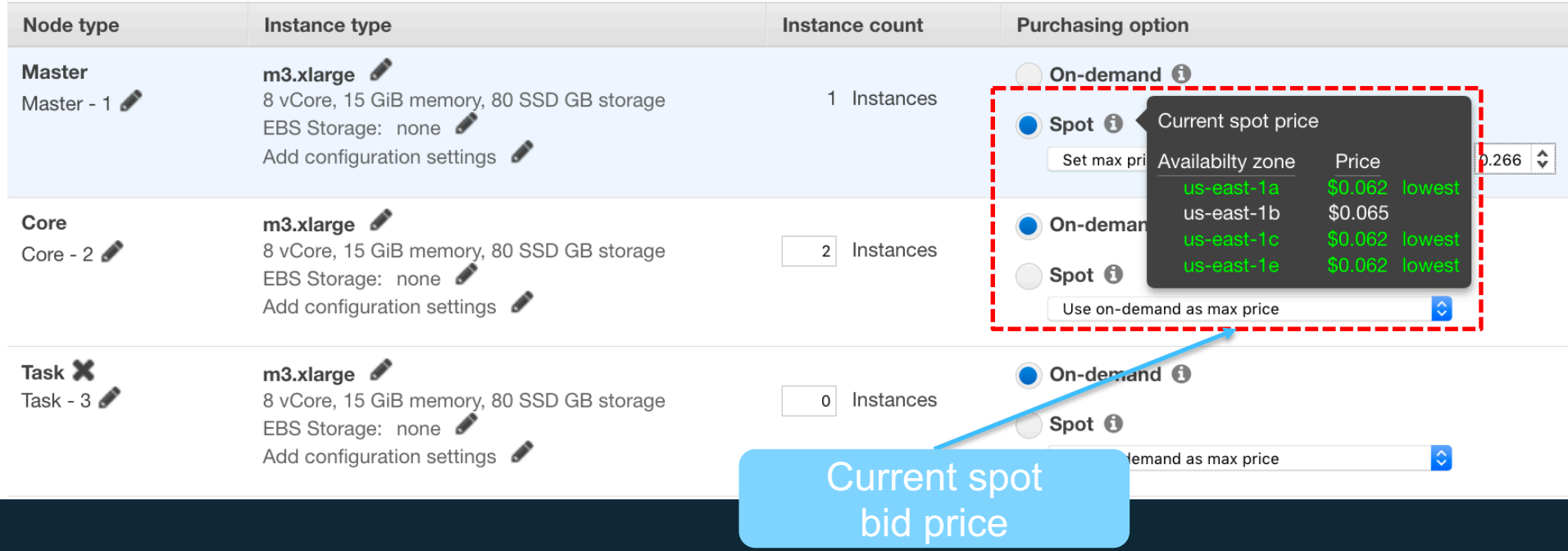
**Root device EBS volume size** 10 GiB

Node types
Instance types
Instance count

For each fleet, specify up to five instance types. For core and task fleets, enter target capacities for on-demand and spot instances. Amazon EMR launches instances from among the types you specify to fulfill the targets. For the master fleet, the target is always one. For each instance type, choose a maximum spot price. The advanced Spot options for each fleet determine Spot provisioning behavior. Learn more

| Node type | Fleet instance types | Target capacity | Advanced Spot options | Auto Scaling |
|---|---|---|---|---|
| **Master**<br>Master - 1 | **m3.xlarge**<br>8 vCore, 15 GiB memory, 80 SSD GB storage<br>EBS Storage: none<br>Maximum Spot price: % On-Demand 100<br>Add / remove instance types to fleet | **On-demand**<br>**Spot**<br>*The master fleet consists of one EC2 instance* | | Not available for instance fleets |
| **Core**<br>Core - 2 | **m3.xlarge**<br>8 vCore, 15 GiB memory, 80 SSD GB storage<br>EBS Storage: none<br>Maximum Spot price: % On-Demand 100<br>Each instance counts as 8 units<br>Add / remove instance types to fleet | 0 On-demand units<br>0 Spot units<br>**0 Total units** | **Defined duration**<br>Not set<br>**Provisioning timeout**<br>Terminate cluster<br>after 60 min. of Spot unavailability | Not available for instance fleets |

# Hardware Configuration – Spot Integration

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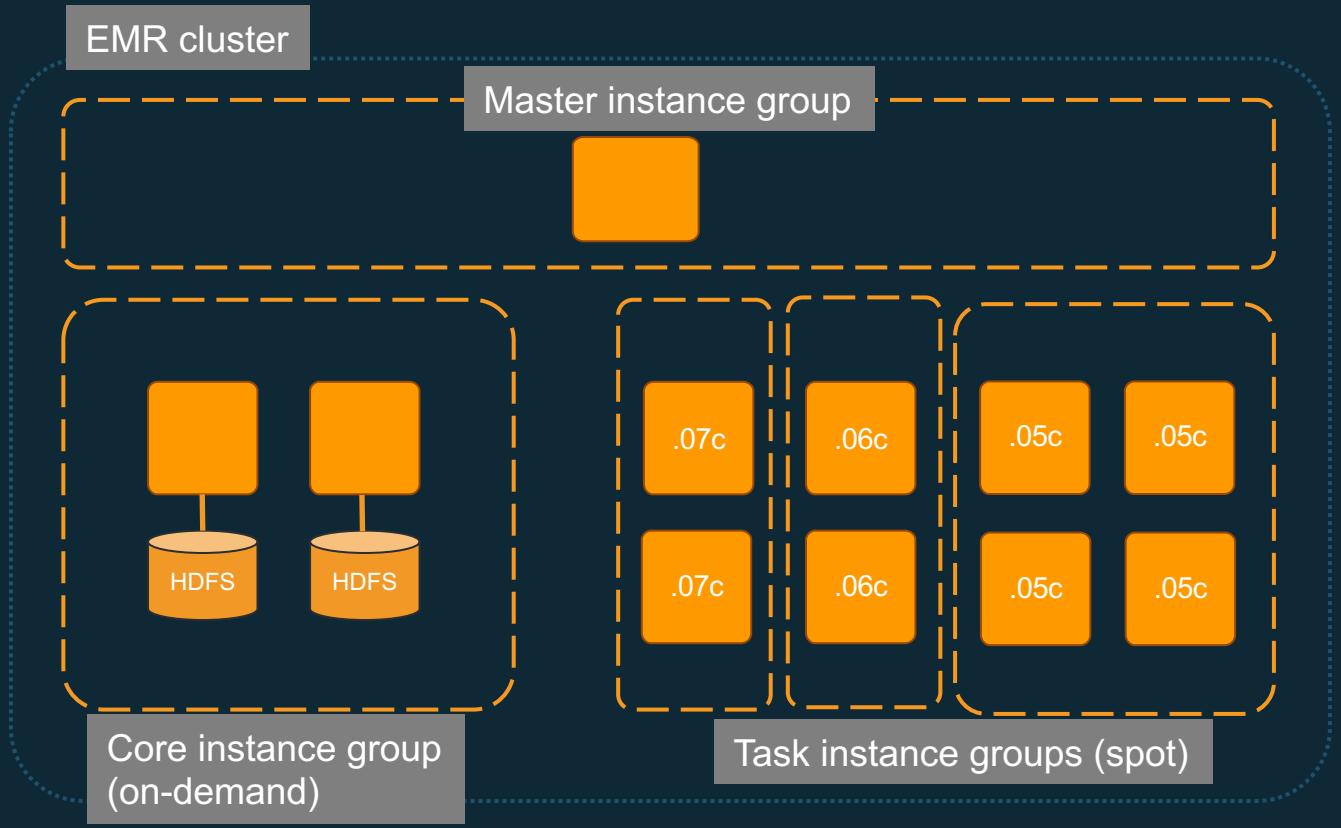
# Hardware Configuration – Multiple Task Groups

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# Hardware Configuration – Auto Scaling

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

Auto scaling option

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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* | | |

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# General Options – Logging

- By default, logs written to master node - /mnt/var/log
  - Step logs
  - Hadoop and YARN component logs
  - Bootstrap Action logs
  - Instance State logs

- If Logging box is checked, logs are also written to S3
  - 5 minute intervals
  - On by default for console
  - Off by default for CLI

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# General Options – Debugging

- When you enable debugging on a cluster, Amazon EMR archives the log files to Amazon S3 and then indexes those files
- You can then use the console to browse the step, job, task, and task-attempt logs for the cluster
- Logs for debugging are also pushed to S3 at 5 minutes intervals

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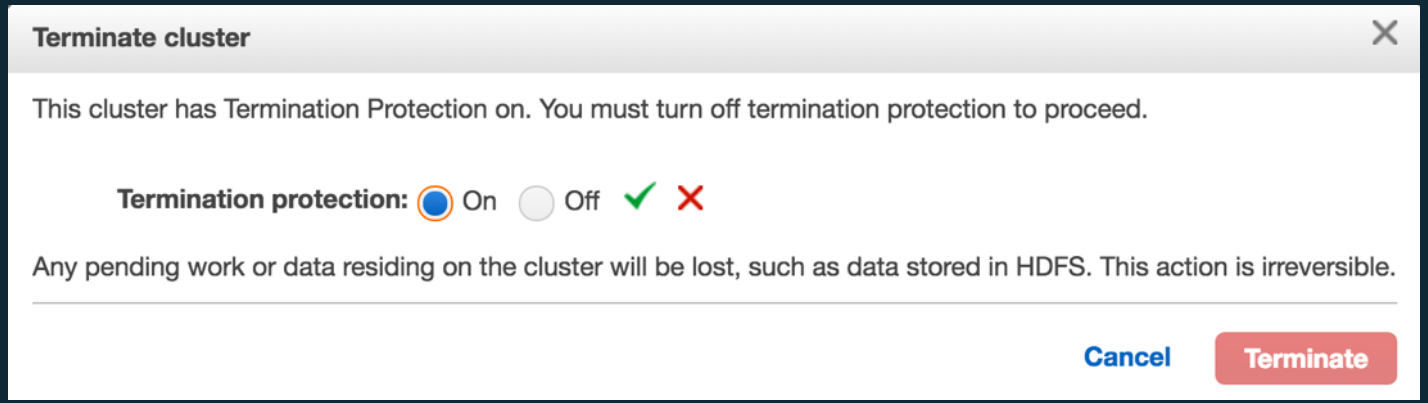
# General Options – Termination Protection

- Prevents accidental termination of the cluster
  - On by default in Console
  - Off by default for CLI

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# General Options – Additional Options

## Additional Options

EMRFS consistent view

EMRFS metadata store

EmrFSMetadata

Number of retries

5

Retry period (in seconds)

10

**Custom AMI ID** None

### Bootstrap Actions

Bootstrap actions are scripts that are executed during setup before Hadoop starts on every cluster node. You can use them to install additional software and customize your applications. Learn more

**Add bootstrap action** Select a bootstrap action Configure and add

# Additional Options – EMRFS Consistent View

- S3 is eventually consistent
- EMRFS consistent view:
  - Uses DynamoDB as a file registry
  - Allows EMR clusters to check for list and read-after-write consistency for Amazon S3 objects written by or synced with EMRFS
- You can configure:
  - Number of times EMFRS calls S3 after finding inconsistency
  - Amount of time until the first retry. Subsequent retries use an exponential back-off

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# Additional Options – Custom AMI

- Benefits
  - Can reduce cluster start time by pre-installing applications and perform other customizations instead of using bootstrap actions
  - Prevent unexpected bootstrap action failures
  - Support for Amazon EBS root volume encryption
- Requirements
  - Must be an *Amazon Linux* AMI. Amazon Linux 2 AMIs are not supported
  - Must be an HVM and an EBS-backed AMI
  - Must be a 64-bit AMI
  - Must not have users with the same name as applications (example: hadoop, hdfs, yarn, or spark)

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# Additional Options – Bootstrap Actions (BA)

- Scripts executed before Hadoop starts on each node
- Typically used for installing additional software
- Can run up to 16 BAs

- Run If
  - Conditional on an instance-specific value found in the instance.json or job-flow.json  i.e. IsMaster=true

- Custom
  - Run custom script. i.e. Copy a file from S3 to each node

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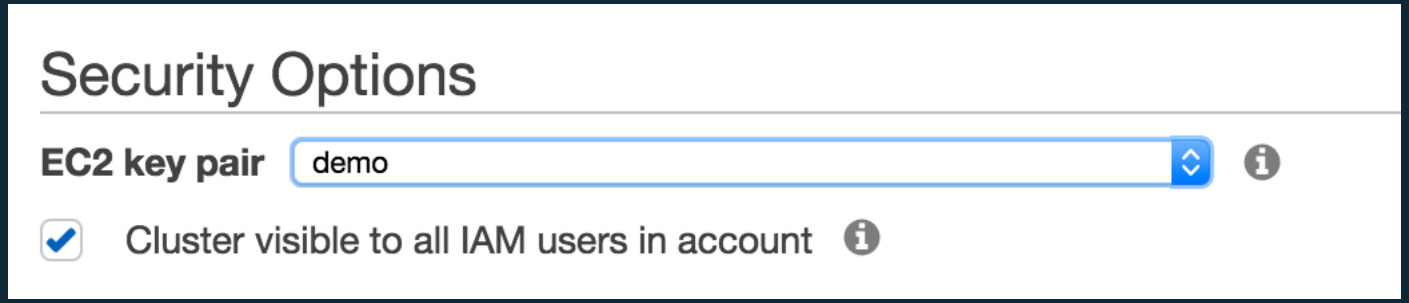
# Security Options – EC2 Key Pair & Visibility




- EC2 key pair
  - Need to attach key pair to be able to SSH into Master node
- Cluster visible
  - If unchecked, only creator can see Cluster in CLI and Console

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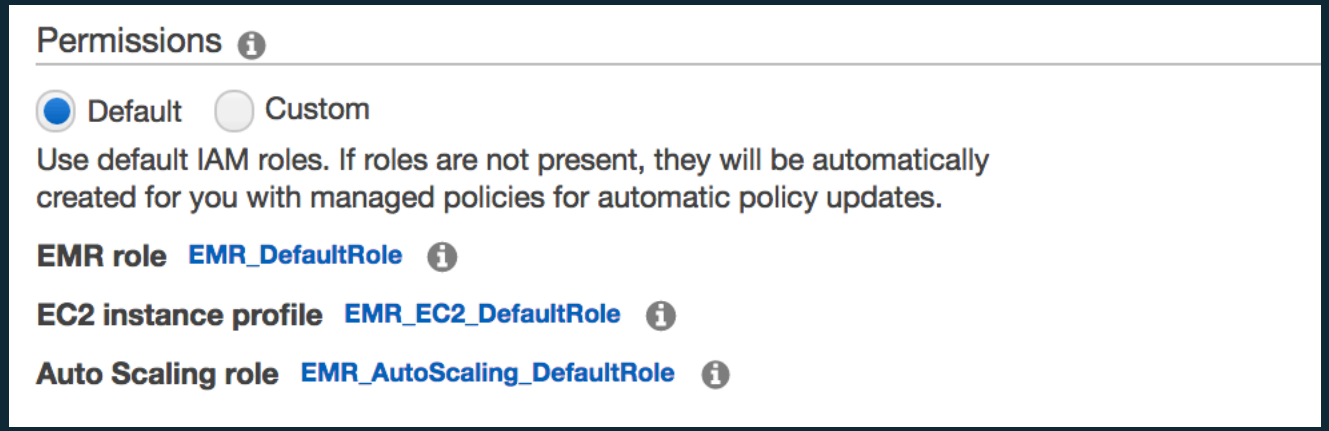
# Security Options – Permissions

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# Security Options – Permissions

- EMR uses Roles to access AWS resources
  - EMR Role
    - Allows EMR to access resources such as EC2
  - EC2 Instance Profile
    - Allows EC2 instances in cluster to access resources such as S3
  - Auto Scaling Role
    - Allows Auto Scaling to add and terminate instances
- Can use default or choose your own

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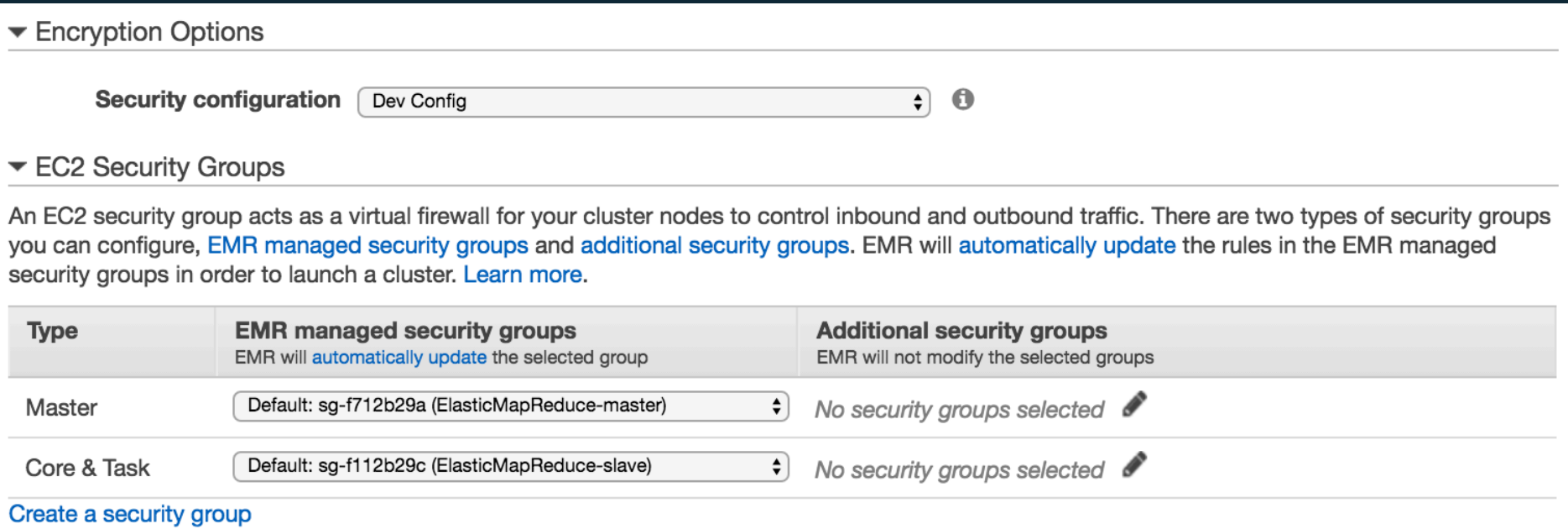
# Security Options – Encryption & Security Groups

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# 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

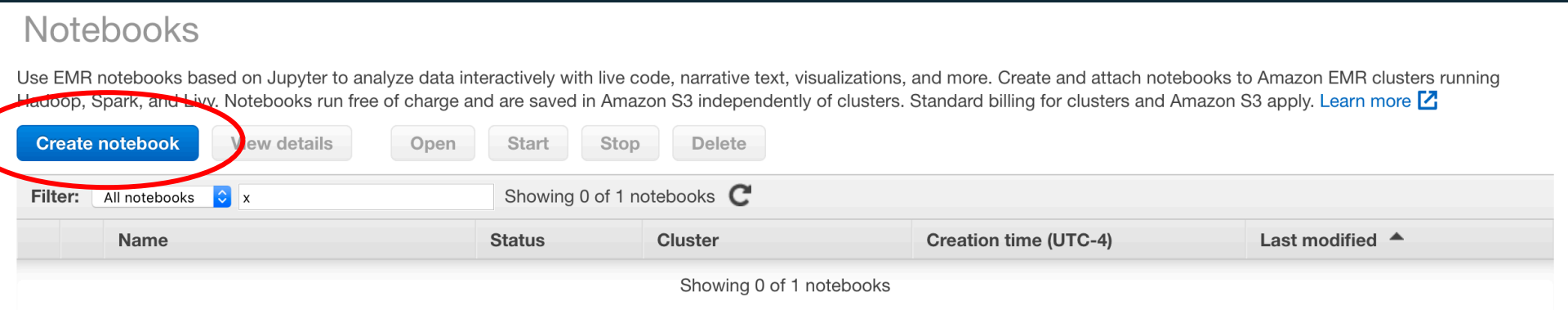
## TLS certificate provider

**Certificate provider type** PEM

**S3 object** s3://

# EMR Notebooks

- Based on Jupyter to analyze data interactively
- Create and attach notebooks to Amazon EMR clusters running Hadoop, Spark, and Livy. Notebooks are saved in Amazon S3 independently of clusters

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# Name and configure your notebook

Name your notebook, choose a cluster or create one, and customize configuration options if desired. Learn more

**Notebook name*** *Specify your notebook name.*

Names may only contain letters (a-z), numbers (0-9), hyphens (-), or underscores (_).

**Description**

256 characters max.

**Cluster*** Choose an existing cluster

Choose

Create a cluster

**Security groups** Use default security groups

Choose security groups

**AWS service role*** EMR_Notebooks_DefaultRole

**Notebook location*** Choose an S3 location where files for this notebook are saved.

Use a location that EMR creates

Choose an existing S3 location in us-east-1

s3://test/notebooks/

**Tags**

© 201

* Required

Cancel Create notebook

# Cluster Details

Cluster: My cluster Waiting Cluster ready after last step completed.

Summary | Application history | Monitoring | Hardware | Events | Steps | Configurations | Bootstrap actions

**Connections:** Enable Web Connection – Hue, Spark History Server, Resource Manager ... (View All)
**Master public DNS:** ec2-54-89-173-61.compute-1.amazonaws.com SSH
**Tags:** Name = My Cluster View All / Edit

### Summary

**ID:** j-3OQFQVKDBEL82
**Creation date:** 2018-06-26 10:14 (UTC-5)
**Elapsed time:** 10 minutes
**Auto-terminate:** No
**Termination protection:** On Change

### Configuration details

**Release label:** emr-5.14.0
**Hadoop distribution:** Amazon 2.8.3
**Applications:** Hive 2.3.2, Pig 0.17.0, Hue 4.1.0, Spark 2.3.0, Livy 0.4.0, Oozie 4.3.0, Sqoop 1.4.7
**Log URI:** s3://tm-app-logs/emr/
**EMRFS consistent view:** Disabled
**Custom AMI ID:** --

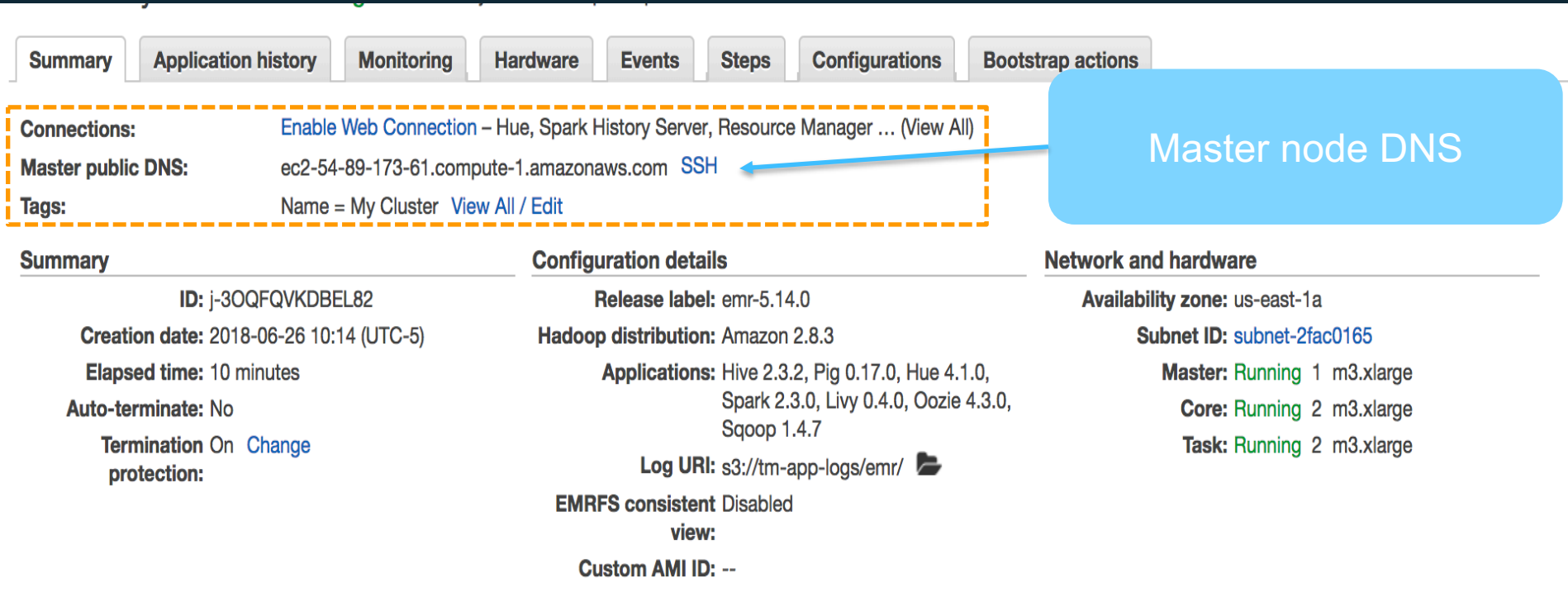
### Network and hardware

**Availability zone:** us-east-1a
**Subnet ID:** subnet-2fac0165
**Master:** Running 1 m3.xlarge
**Core:** Running 2 m3.xlarge
**Task:** Running 2 m3.xlarge

### Security and access

**Key name:** dev-virginia
**EC2 instance profile:** EMR_EC2_DefaultRole
**EMR role:** EMR_DefaultRole
**Auto Scaling role:** EMR_AutoScaling_DefaultRole
**Visible to all users:** All Change
**Security groups for Master:** sg-8ebea5fb (emr-master)
**Security groups for Core & Task:** sg-d3b8a3a6 (emr-slave)

# Cluster Details

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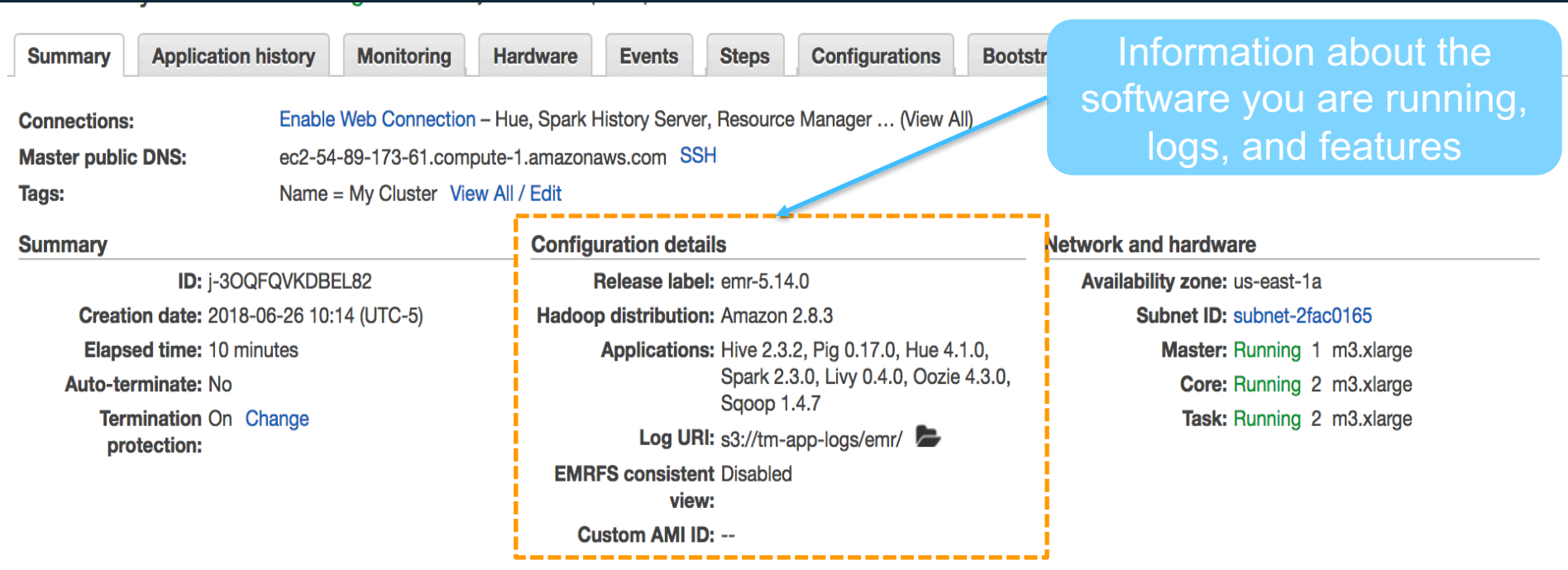
# Cluster Details

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# Cluster Details

Summary | Application history | Monitoring | Hardware | Events | Steps | Configurations | Bootstrap actions

**Connections:** Enable Web Connection – Hue, S
**Master public DNS:** ec2-54-89-173-61.compute-1.an
**Tags:** Name = My Cluster View All / Ed

Information on the infrastructure for this cluster

**Summary**

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# Cluster Details

**Summary**

| | |
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| **Elapsed time:** | 10 minutes |
| **Auto-terminate:** | No |
| **Termination protection:** | On Change |

**Configuration details**

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|---|---|
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**Security and access**

| | |
|---|---|
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| **EMR role:** | EMR_DefaultRole |
| **Auto Scaling role:** | EMR_AutoScaling_DefaultRole |
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| **Security groups for Core & Task:** | sg-d3b8a3a6 (emr-slave) |

Information on security groups and IAM roles

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