Deploy Analytical Data Platform on AWS in One Day

Every business is focused on a rapid time to market and return on investment. It's no longer enough to implement a data lake, businesses require a data platform that can provide immediately actionable insights. But building a data platform from the ground up can take a significant amount of time so Grid Dynamics has developed an accelerator to help companies achieve this far more quickly. This article provides a step by step guide on how to run the accelerator on AWS from scratch.

What does Analytical Data Platform provide?

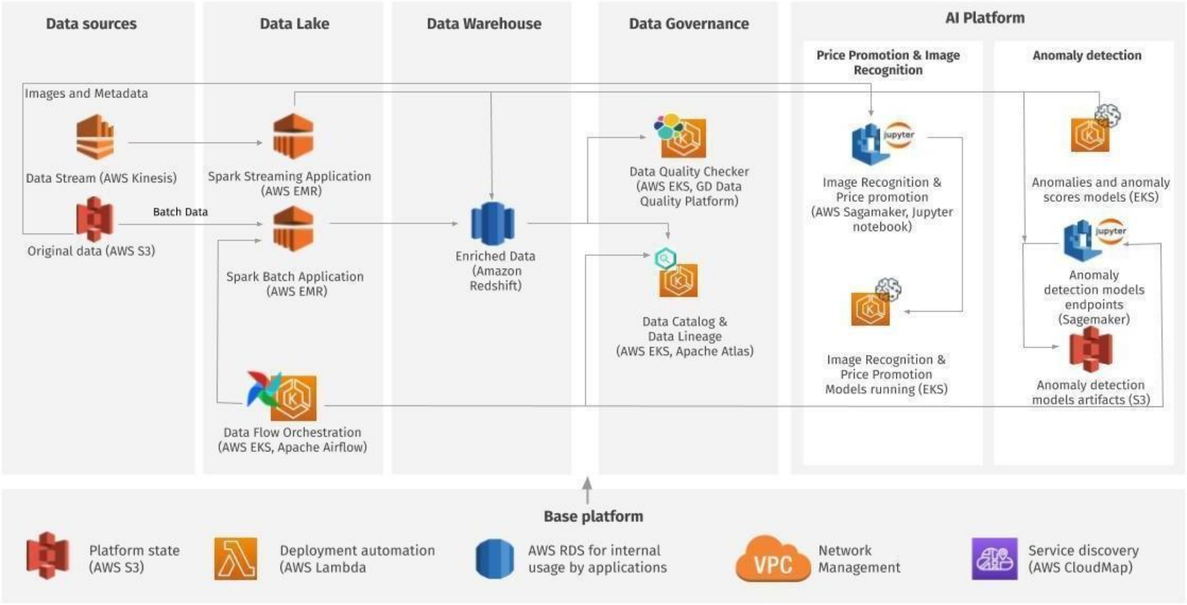
The accelerator comes as an AWS Marketplace solution or application in AWS Service Catalog.
It provides six capabilities or use cases that can be deployed on top of AWS and each capability can be provisioned separately. As they are re-using the same infrastructure, if EMR is already provisioned by one of them, it doesn't need to be provisioned again.

The potential use cases are outlined below:

- **Data lake** - is built on top of S3 with data catalog and data lineage available in Apache Atlas.
- **Enterprise data warehouse** - use case runs on top of Redshift.
- **Batch analytics** - use case covers typical batch processing and analytics using data lake, EDW, and jobs running on top of EMR and orchestrated by Apache Airflow.
- **Stream analytics** - covers the stream processing and stream analytics use cases and examples with Amazon Kinesis, Apache Spark, and pipeline orchestration with Apache Airflow.
- **Data governance** - provides tools for data catalog, data glossary, data lineage, data monitoring, and data quality. The data catalog, glossary, and lineage are implemented with Apache Atlas. Data monitoring and quality capabilities are implemented with the Kibana, ElasticSearch, Grafana, k8s, and a number of custom applications.
- **CI/CD** - the platform is deployed from scratch by CloudFormation scripts and custom lambdas.
- **Anomaly detection** - for more information about the anomaly detection architecture and technology stack, refer to a separate article on how to add anomaly detection to your data pipelines.
- **AI/ML use cases** - we included two AI use cases in the accelerator to demonstrate end-to-end functionality. All use cases are implemented with Amazon Sagemaker and Jupyter Notebooks and use the data we prepared in the data lake and EDW. One of the use cases contains a model to detect attributes in an e-commerce product catalog, while the second implements price optimization and promotion planning. We kept the use case implementations simple for the purposes of the demo.

If you're interested in production implementation of these use cases, please read articles about product attribution with image recognition and price and promotion optimization or reach out to us.

The data platform enables DataOps practices and is ready to integrate with external data sources. The high-level architecture of the platform is outlined in the diagram below:


Data sources
Data Lake
Data Warehouse
Data Governance
AI Platform
Price Promotion & Image Recognition
Anomaly detection
Images and Metadata
Data Stream (AWS Kinesis)
Spark Streaming Application (AWS EMR)
Batch Data
Original data (AWS S3)
Spark Batch Application (AWS EMR)
Enriched Data (Amazon Redshift)
Data Quality Checker (AWS EKS, GD Data Quality Platform)
Data Catalog & Data Lineage (AWS EKS, Apache Atlas)
Image Recognition & Price promotion (AWS Sagamaker, Jupyter notebook)
Image Recognition & Price Promotion Models running (EKS)
Anomalies and anomaly scores models (EKS)
Anomaly detection models endpoints (Sagemaker)
Anomaly detection models artifacts (S3)
Data Flow Orchestration (AWS EKS, Apache Airflow)
Base platform
Platform state (AWS S3)
Deployment automation (AWS Lambda
AWS RDS for internal usage by applications
VPC
Network Management
Service discovery (AWS CloudMap)

Below we will cover all the platform's capabilities in more detail but before jumping into describing them, it's worth mentioning that the platform is distributed as either an AWS Marketplace or Service Catalog application. The difference between Marketplace and Service Catalog is that while Marketplace applications are publicly available, Service Catalog solutions are private and can be shared with other organizations.

This article will essentially be about installation from AWS Marketplace to AWS Service Catalog. As of now there is no easy way to install Marketplace container based products directly into Service Catalog (for AMI-based there is single click functionality) so as a prerequisite, detailed instruction will be provided on how to install products to Service Catalog.

Prerequisites

In AWS Marketplace, the following list of solutions are available:

1. Base platform
2. Use cases

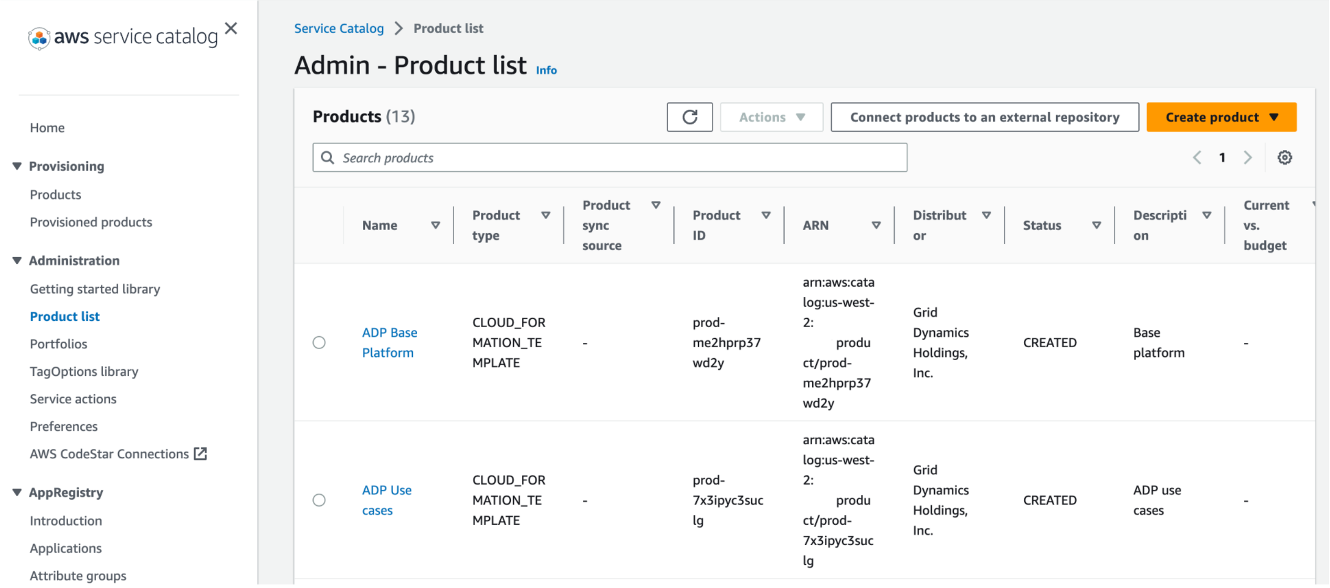
   Use cases comprises:

   1. Batch capability
   2. Streaming capability
   3. Data Quality capability
   4. Data Governance capability
   5. Dashboard capability
   6. ML capability: Visual Attributes
   7. ML capability: Promotion Planning
   8. ML capability: ML Operations

9. ML capability: ML observability

Base platform and **Use cases** on the installation page provides a link to the S3 bucket where all CloudFormation scripts reside. These products should be installed to Service Catalog in any order one by one:

1. Take the S3 URL to CloudFormation scripts
2. Go to AWS Service Catalog
3. On the left panel in the **Administration** section click on **Products list:**

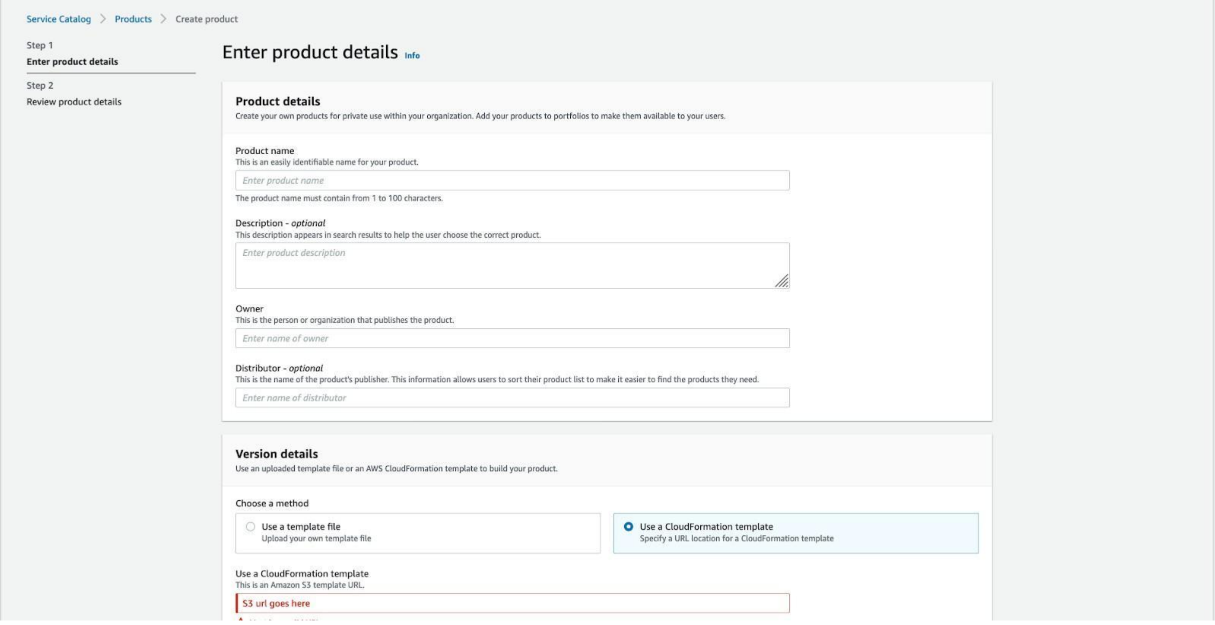


Admin - Product list

Products (13)

	Name	Product type	Product sync source	Product ID	ARN	Distributor	Status	Description	Current vs. budget
○	ADP Base Platform	CLOUD_FORMATION_TEMPLATE	-	prod-me2hprp37wd2y	arn:aws:catalog:us-west-2: product/prod-me2hprp37wd2y	Grid Dynamics Holdings, Inc.	CREATED	Base platform	-
○	ADP Use cases	CLOUD_FORMATION_TEMPLATE	-	prod-7x3ipyc3suclg	arn:aws:catalog:us-west-2: product/prod-7x3ipyc3suclg	Grid Dynamics Holdings, Inc.	CREATED	ADP use cases	-

4. On the right side click to **Upload new products**:



Enter product details

Product details

Create your own products for private use within your organization. Add your products to portfolios to make them available to your users.

Product name
This is an easily identifiable name for your product.
Enter product name
The product name must contain from 1 to 100 characters.

Description - *optional*
This description appears in search results to help the user choose the correct product.
Enter product description

Owner
This is the person or organization that publishes the product.
Enter name of owner

Distributor - *optional*
This is the name of the product's publisher. This information allows users to sort their product list to make it easier to find the products they need.
Enter name of distributor

Version details

Use an uploaded template file or an AWS CloudFormation template to build your product.

Choose a method

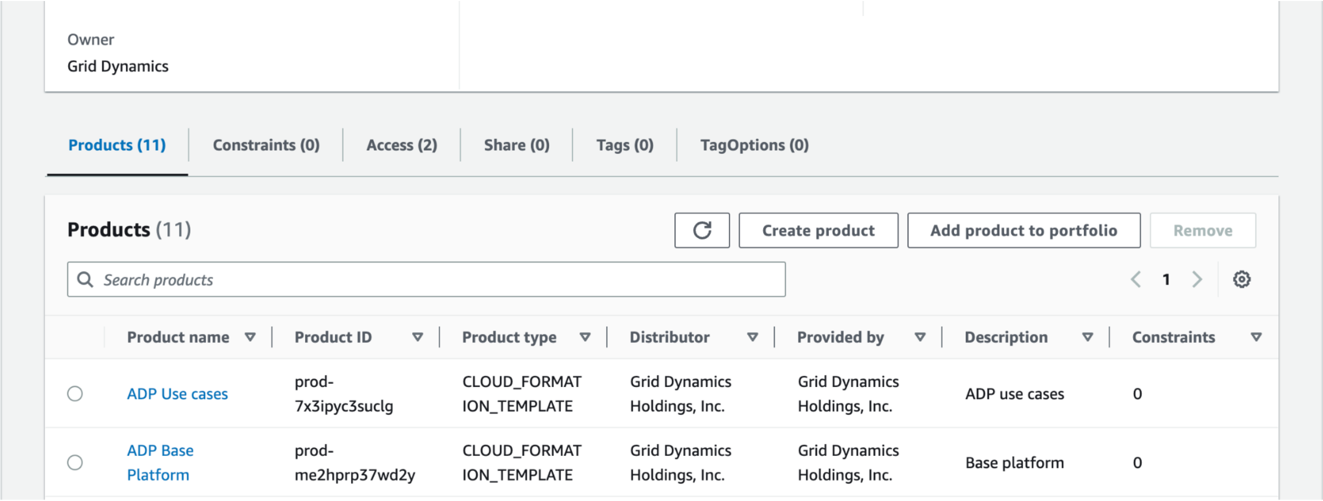
○ Use a template file
Upload your own template file

● Use a CloudFormation template
Specify a URL location for a CloudFormation template

Use a CloudFormation template
This is an Amazon S3 template URL.
S3 url goes here

5. Enter the product name and paste the S3 URL from Marketplace
6. You're done, the product is now created

Once a product is created, it should be added to a portfolio. All permissions for a product will be managed by portfolio. To create a portfolio just click on the Portfolio link on the left panel and create a new one of re-use existing. Product listing in portfolio will look like on image below



Owner
Grid Dynamics

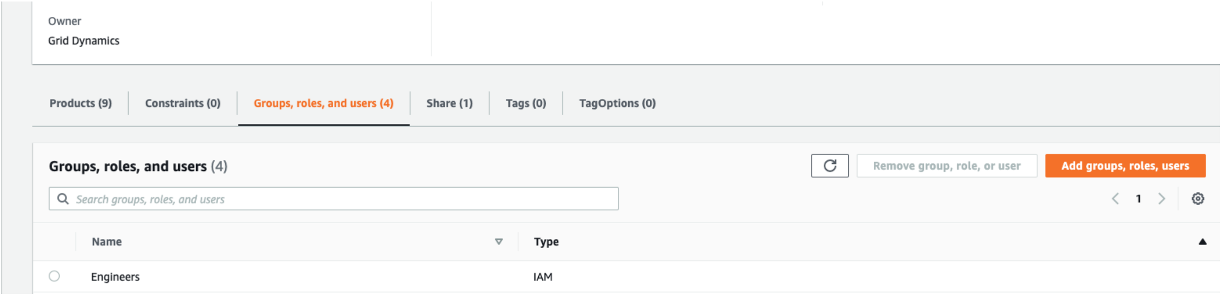
Products (11)

	Product name	Product ID	Product type	Distributor	Provided by	Description	Constraints
○	ADP Use cases	prod-7x3ipyc3suclg	CLOUD_FORMATION_TEMPLATE	Grid Dynamics Holdings, Inc.	Grid Dynamics Holdings, Inc.	ADP use cases	0
○	ADP Base Platform	prod-me2hprp37wd2y	CLOUD_FORMATION_TEMPLATE	Grid Dynamics Holdings, Inc.	Grid Dynamics Holdings, Inc.	Base platform	0

You’re done, now the final step will be to create permissions and assign to the created portfolio. There are two ways:

1. Attach a group, like engineering group
2. Or specific, not a root user

On the image below engineering group is attached:


Products (9)
Constraints (0)
Groups, roles, and users (4)
Share (1)
Tags (0)
TagOptions (0)
Remove group, role, or user
Add groups, roles, users
Search groups, roles, and users
1

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Groups, roles, and users (4)

	Name	Type
○	Engineers	IAM

If there are no specific groups created, follow security configuration steps below:

Security configuration

1. Create two Engineer Policies with access to ServiceCatalog and IAM actions accessPermission policy for Engineer Group might looks like below, can be adjusted if needed and replace <ACCOUNT_ID> to your account and <RESOURCE_PREFIX> to your prefix in the platform:

1.1 High level policy:

```
{
   "Version": "2012-10-17",
   "Statement": [
      {
         "Effect": "Allow",
         "Action": [
            "iam:CreateRole",
            "iam:Get*",
            "iam:List*"
         ],
         "Resource": [
            "arn:aws:iam::<ACCOUNT_ID>:role/*"
            ]
        },
        {
            "Effect": "Allow",
            "Action": [
                "iam:AddUserToGroup",
                "iam:CreateGroup",
                "iam:DeleteGroup",
                "iam:DeleteGroupPolicy",
                "iam:GetGroup",
                "iam:GetGroupPolicy",
                "iam:PutGroupPolicy"
            ],
            "Resource": [
                "arn:aws:iam::<ACCOUNT_ID>:group/*ADPMLEngineer*",
                "arn:aws:iam::<ACCOUNT_ID>:group/*ADPDQEngineer*",
                "arn:aws:iam::<ACCOUNT_ID>:group/*ADPDevOpsEngineer*",
                "arn:aws:iam::<ACCOUNT_ID>:group/*ADPBigDataEngineer*"
            ]
        },
        {
            "Effect": "Allow",
            "Action": [
                "iam:AttachRolePolicy",
                "iam:DetachRolePolicy”,
                "iam:DeleteRolePolicy",
                "iam:DeleteRole"
            ],
            "Resource": [
                "arn:aws:iam::<ACCOUNT_ID>:role/SC-<ACCOUNT_ID>-pp-*",
                "arn:aws:iam::<ACCOUNT_ID>:role/*-Churn-Predictions-*"
            ]
        },
        {
            "Effect": "Allow",
            "Action": [
                "iam:PassRole",
                "iam:PutRolePolicy"
            ],
            "Resource": [
                "arn:aws:iam::<ACCOUNT_ID>:role/SC-<ACCOUNT_ID>-pp-*",
                "arn:aws:iam::<ACCOUNT_ID>:role/eks-quickstart-*",
                "arn:aws:iam::<ACCOUNT_ID>:role/<RESOURCE_PREFIX>-*",
                "arn:aws:iam::<ACCOUNT_ID>:role/<RESOURCE_PREFIX>-Churn-Predictions-*"
            ]
        },
        {
            "Effect": "Allow",
            "Action":
            "s3:GetObject",
            "Resource": "*",
            "Condition": {
                "StringEquals": {
                    "s3:ExistingObjectTag/servicecatalog:provisioning": "true"
                }
            }
        }
    ]
}
```

1.2 Medium level policy:

```
{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Effect": "Allow",
            "Action": [
                "elasticmapreduce:RunJobFlow",
                "kms:Decrypt",
                "kms:GenerateDataKey",
                "lambda:CreateFunction",
                "lambda:DeleteFunction",
                "lambda:GetFunction",
                "lambda:InvokeFunction",
                "lambda:UpdateFunctionCode",
                "rds:AddTagsToResource",
                "rds:CreateDBInstance",
                "rds:CreateDBSubnetGroup",
                "rds:DeleteDBInstance",
                "rds:DescribeDBInstances",
                "rds:DeleteDBSubnetGroup",
                "rds:DescribeDBSubnetGroups",
                "rds:ListTagsForResource",
                "rds:RemoveTagsFromResource",
                "sagemaker:CreateModel",
                "sagemaker:CreateNotebookInstance",
                "sagemaker:DeleteEndpoint",
                "sagemaker:DeleteEndpointConfig",
                "sagemaker:DeleteModel",
                "sagemaker:DeleteNotebookInstance",
                "sagemaker:DescribeEndpoint",
                "sagemaker:DescribeModel",
                "sagemaker:DescribeNotebookInstance",
                "sagemaker:StartNotebookInstance",
                "sagemaker:UpdateNotebookInstance",
                "sagemaker:*NotebookInstanceLifecycleConfig",
                "secretsmanager:GetSecretValue",
                "secretsmanager:TagResource",
                "secretsmanager:UntagResource",
                "servicediscovery:CreateService",
                "servicediscovery:DeleteService",
                "s3:Get*",
                "s3:ListBucket",
                "s3:ListBucketMultipartUploads",
                "s3:ListBucketVersions",
                "s3:ListMultipartUploadParts",
                "s3:PutEncryptionConfiguration"
            ],
            "Resource": [
                "arn:aws:kms:*:<ACCOUNT_ID>:key/*",
                "arn:aws:lambda:*:<ACCOUNT_ID>:function:eks-quickstart-*",
                "arn:aws:lambda:*:<ACCOUNT_ID>:function:SC-*",
                "arn:aws:lambda:*:<ACCOUNT_ID>:function:QuickStart*",
                "arn:aws:lambda:*:<ACCOUNT_ID>:function:EKS-QuickStart-*",
                "arn:aws:rds:*:<ACCOUNT_ID>:db:*",
                "arn:aws:rds:*:<ACCOUNT_ID>:subgrp:*-ai4ops-rds",
                "arn:aws:rds:*:<ACCOUNT_ID>:subgrp:*-dqweb-rds",
                "arn:aws:servicediscovery:*:<ACCOUNT_ID>:service/*",
                "arn:aws:servicediscovery:*:<ACCOUNT_ID>:namespace/*",
            "arn:aws:sagemaker:*:<ACCOUNT_ID>:notebook-instance-lifecycle-config/*",
            "arn:aws:sagemaker:*:<ACCOUNT_ID>:endpoint/*",
            "arn:aws:sagemaker:*:<ACCOUNT_ID>:model/*",
            "arn:aws:sagemaker:*:<ACCOUNT_ID>:endpoint-config/*",
            "arn:aws:sagemaker:*:<ACCOUNT_ID>:notebook-instance/*",
            "arn:aws:secretsmanager:*:<ACCOUNT_ID>:secret:*",
            "arn:aws:s3:::griddynamics-analytical-data-platform-snapshots",
            "arn:aws:s3:::griddynamics-analytical-data-platform-releases",
            "arn:aws:s3:::griddynamics-analytical-data-platform-snapshots/*",
            "arn:aws:s3:::griddynamics-analytical-data-platform-releases/*",
            "arn:aws:s3:::cf-templates-*",
            "arn:aws:s3:::sc-*-pp-*"
        ]
    },
    {
        "Effect": "Allow",
        "Action": [
            "kinesis:AddTagsToStream",
            "kinesis:CreateStream",
            "kinesis:DeleteStream",
            "kinesis:DescribeStream*",
            "kinesis:ListTagsForStream",
            "kinesis:RemoveTagsFromStream",
            "lambda:GetLayerVersion",
            "lambda:PublishLayerVersion",
            "secretsmanager:CreateSecret",
            "secretsmanager:DeleteSecret",
            "s3:CreateBucket",
            "s3:DeleteBucket",
            "s3:ListBucket",
            "s3:PutBucketTagging"
        ],
        "Resource": [
            "arn:aws:kinesis:*:<ACCOUNT_ID>:stream/*-ai4ops-stream",
            "arn:aws:lambda:*:<ACCOUNT_ID>:layer:*",
            "arn:aws:secretsmanager:*:<ACCOUNT_ID>:secret:*",
            "arn:aws:s3:::*-batch-*",
            "arn:aws:s3:::*-streaming-*",
            "arn:aws:s3:::*-pipeline-*",
            "arn:aws:s3:::*-platform-state",
            "arn:aws:s3:::sc-*-pp-*",
            "arn:aws:s3:::cf-templates-*"
        ]
    },
    {
        "Effect": "Allow",
        "Action": "lambda:DeleteLayerVersion",
        "Resource": "arn:aws:lambda:*:<ACCOUNT_ID>:layer:*:*"
    },
    {
        "Effect": "Allow",
        "Action": "s3:PutObject",
        "Resource": "arn:aws:s3:::cf-templates-*"
    },
    {
        "Effect": "Allow",
        "Action": [
            "cloudformation:CreateChangeSet",
            "cloudformation:ListStacks",
            "ec2:AllocateAddress",
            "ec2:AssociateDhcpOptions",
            "ec2:AssociateRouteTable",
            "ec2:AttachInternetGateway",
            "ec2:AttachNetworkInterface",
            "ec2:AuthorizeSecurityGroupEgress",
            "ec2:AuthorizeSecurityGroupIngress",
            "ec2:CreateDhcpOptions",
            "ec2:CreateInternetGateway",
            "ec2:CreateKeyPair",
            "ec2:CreateNatGateway",
            "ec2:CreateNetworkInterface",
            "ec2:CreateNetworkInterfacePermission",
            "ec2:CreateRoute",
            "ec2:CreateRouteTable",
            "ec2:CreateSecurityGroup",
            "ec2:CreateSubnet",
            "ec2:CreateTags",
            "ec2:CreateVpc",
            "ec2:CreateVpcEndpoint",
            "ec2:DeleteDhcpOptions",
            "ec2:DeleteInternetGateway",
            "ec2:DeleteNatGateway",
            "ec2:DeleteNetworkAcl",
            "ec2:DeleteNetworkAclEntry",
            "ec2:DeleteNetworkInterface",
            "ec2:DeleteRoute",
            "ec2:DeleteRouteTable",
            "ec2:DeleteSecurityGroup",
            "ec2:DeleteSubnet",
            "ec2:DeleteVpc",
            "ec2:DeleteVpcEndpoints",
            "ec2:Describe*",
            "ec2:DetachInternetGateway",
            "ec2:DetachNetworkInterface",
            "ec2:DisassociateRouteTable",
            "ec2:ModifySubnetAttribute",
            "ec2:ModifyVpcAttribute",
            "ec2:ReleaseAddress",
            "ec2:RevokeSecurityGroupEgress",
            "ec2:RevokeSecurityGroupIngress",
            "ec2:UpdateSecurityGroupRuleDescriptionsEgress",
            "ec2:UpdateSecurityGroupRuleDescriptionsIngress",
            "health:DescribeEventAggregates",
            "lambda:ListFunctions",
            "route53:ChangeResourceRecordSets",
            "route53:CreateHealthCheck",
            "route53:CreateHostedZone",
            "route53:DeleteHealthCheck",
            "route53:GetHealthCheck",
            "route53:GetHostedZone",
            "route53:ListHostedZonesByName",
            "route53:UpdateHealthCheck",
            "servicediscovery:DeleteNamespace",
            "servicediscovery:DeregisterInstance",
            "servicediscovery:DiscoverInstances",
            "servicediscovery:CreateHttpNamespace",
            "servicediscovery:CreatePrivateDnsNamespace",
            "servicediscovery:CreatePublicDnsNamespace",
            "servicediscovery:Get*",
            "servicediscovery:List*",
            "servicediscovery:RegisterInstance",
            "servicediscovery:TagResource",
            "servicediscovery:UntagResource",
            "secretsmanager:GetRandomPassword",
            "s3:GetAccessPoint",
            "s3:GetAccountPublicAccessBlock",
            "s3:ListAccessPoints",
            "s3:ListAccessPointsForObjectLambda",
            "s3:ListAllMyBuckets",
            "s3:ListJobs",
            "s3:ListMultiRegionAccessPoints",
            "s3:ListStorageLensConfigurations"
          ],
          "Resource": "*"
        }
      ]
    }
```

1.3 Low level policy:

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow",
      "Action": [
        "codepipeline:CreatePipeline",
        "codepipeline:DeletePipeline",
        "codepipeline:GetPipeline",
        "codepipeline:GetPipelineState",
        "codepipeline:TagResource",
        "codepipeline:UntagResource",
        "codepipeline:UpdatePipeline"
      ],
      "Resource": [
        "arn:aws:codepipeline:*:<ACCOUNT_ID>:*-mlflow-BuildPipeline",
        "arn:aws:codepipeline:*:<ACCOUNT_ID>:actiontype:*/*/*/*",
        "arn:aws:codepipeline:*:<ACCOUNT_ID>:webhook:*",
        "arn:aws:codepipeline:*:<ACCOUNT_ID>:*-mlflow-BuildPipeline/*"
      ]
    },
    {
      "Effect": "Allow",
      "Action": [
        "codebuild:ImportSourceCredentials",
        "codebuild:DeleteOAuthToken",
        "codebuild:DeleteSourceCredentials",
        "codebuild:ListBuilds",
        "codebuild:ListBuildBatches",
        "codebuild:ListConnectedOAuthAccounts",
        "codebuild:ListCuratedEnvironmentImages",
        "codebuild:ListProjects",
        "codebuild:ListReportGroups",
        "codebuild:ListReports",
        "codebuild:ListRepositories",
        "codebuild:ListSharedProjects",
        "codebuild:ListSharedReportGroups",
        "codebuild:ListSourceCredentials",
        "codebuild:PersistOAuthToken",
        "codepipeline:ListPipelines",
        "codestar-connections:CreateConnection",
        "codestar-connections:DeleteConnection",
        "codestar-connections:GetConnection",
        "codestar-connections:ListTagsForResource",
        "codestar-connections:PassConnection",
        "codestar-connections:TagResource",
        "elasticmapreduce:DescribeCluster",
        "elasticmapreduce:ListInstanceGroups",
        "elasticmapreduce:RunJobFlow",
        "elasticmapreduce:TerminateJobFlows"
      ],
      "Resource": "*"
    },
    {
      "Effect": "Allow",
      "Action":
      "codebuild:*",
      "Resource": [
        "arn:aws:codebuild:*:<ACCOUNT_ID>:project/<RESOURCE_PREFIX>-*",
        "arn:aws:codebuild:*:<ACCOUNT_ID>:report-group/*"
      ]
    }
  ]
}
```

***Important*!** Don't forget to change <ACCOUNT_ID> to your account and <RESOURCE_PREFIX> to your prefix on the platform!

2. Create an **Engineer** group, attach new created policies and attach *AWSServiceCatalogAdminFullAccess* policy to the group.

3. Create a new user (engineer) for ServiceCatalog and CFN usage (do not use root user!).

4. Add a new user to **Engineer** group.

5. Create a key pair for capability for SSH access to the bastion host.

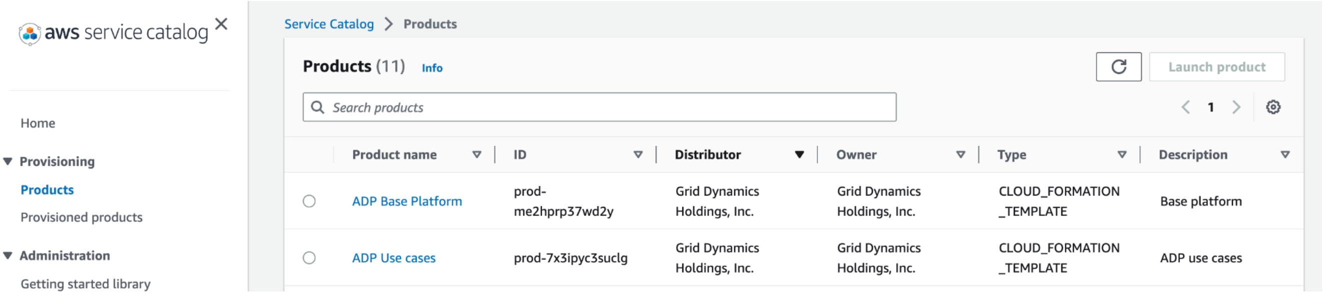
6. Login in AWS under created user.

Warning:

> *The deployment template will create IAM roles that has the ability to create additional IAM roles that may or may not include administrator permissions to the customer account where it is deployed.*

All further actions will be done in Service Catalog in AWS console

All security configurations are done, you can proceed to run the platform with service catalog applications looking like on the image:



	Product name	ID	Distributor	Owner	Type	Description
○	ADP Base Platform	prod-me2hprp37wd2y	Grid Dynamics Holdings, Inc.	Grid Dynamics Holdings, Inc.	CLOUD_FORMATION_TEMPLATE	Base platform
○	ADP Use cases	prod-7x3ipyc3suclg	Grid Dynamics Holdings, Inc.	Grid Dynamics Holdings, Inc.	CLOUD_FORMATION_TEMPLATE	ADP use cases

How to access platform web services?

There are several ways how to access any web service which is running in private AWS network:

1. Share the same VPN network with common DNS
2. AWS Private link
3. Access AWS services through SSH tunneling - AWS manual

Platform has capability to expose all private web applications to a public network, but it was designed and used only for demo purpose, we highly recommend to keep all services in a private network.

Base platform

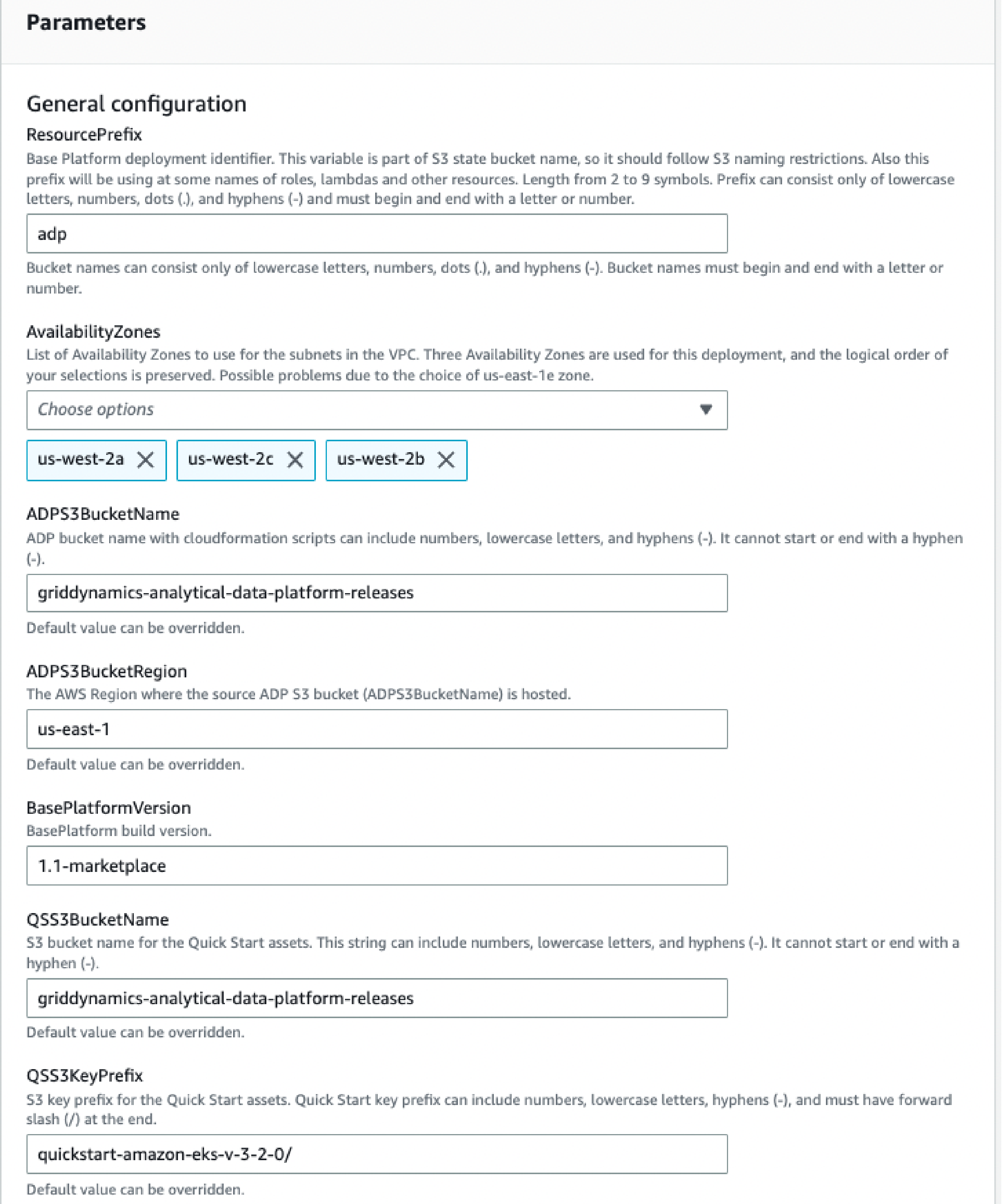
The Analytical Data Platform has a base platform responsible for provisioning networks, S3 buckets with CloudFormation code and Lambdas, and a common state, which is used to share common services like EMR or EKS between use cases. Once the base platform is in place any capability can be deployed in any order.

To launch the base platform, four parameters should be defined:

- Resource prefix
- SSH keys to use
- Remote access CIDR
- Availability zones - at least three should be chosen

EKS requires at least three availability zones to be present in the AWS region, so before deploying the data platform please ensure that constraint is met. Further information regarding availability zones can be found on the AWS status page.

In the example below, the resource prefix is *adp-base-platform*, ssh key pair is *test*, remote access CIDR is allowing all IP addresses, and there are three availability zones defined:



Parameters

General configuration

ResourcePrefix

Base Platform deployment identifier. This variable is part of S3 state bucket name, so it should follow S3 naming restrictions. Also this prefix will be using at some names of roles, lambdas and other resources. Length from 2 to 9 symbols. Prefix can consist only of lowercase letters, numbers, dots (.), and hyphens (-) and must begin and end with a letter or number.

adp

Bucket names can consist only of lowercase letters, numbers, dots (.), and hyphens (-). Bucket names must begin and end with a letter or number.

AvailabilityZones

List of Availability Zones to use for the subnets in the VPC. Three Availability Zones are used for this deployment, and the logical order of your selections is preserved. Possible problems due to the choice of us-east-1e zone.

Choose options ▼

us-west-2a ✕ us-west-2c ✕ us-west-2b ✕

ADPS3BucketName

ADP bucket name with cloudformation scripts can include numbers, lowercase letters, and hyphens (-). It cannot start or end with a hyphen (-).

griddynamics-analytical-data-platform-releases

Default value can be overridden.

ADPS3BucketRegion

The AWS Region where the source ADP S3 bucket (ADPS3BucketName) is hosted.

us-east-1

Default value can be overridden.

BasePlatformVersion

BasePlatform build version.

1.1-marketplace

QSS3BucketName

S3 bucket name for the Quick Start assets. This string can include numbers, lowercase letters, and hyphens (-). It cannot start or end with a hyphen (-).

griddynamics-analytical-data-platform-releases

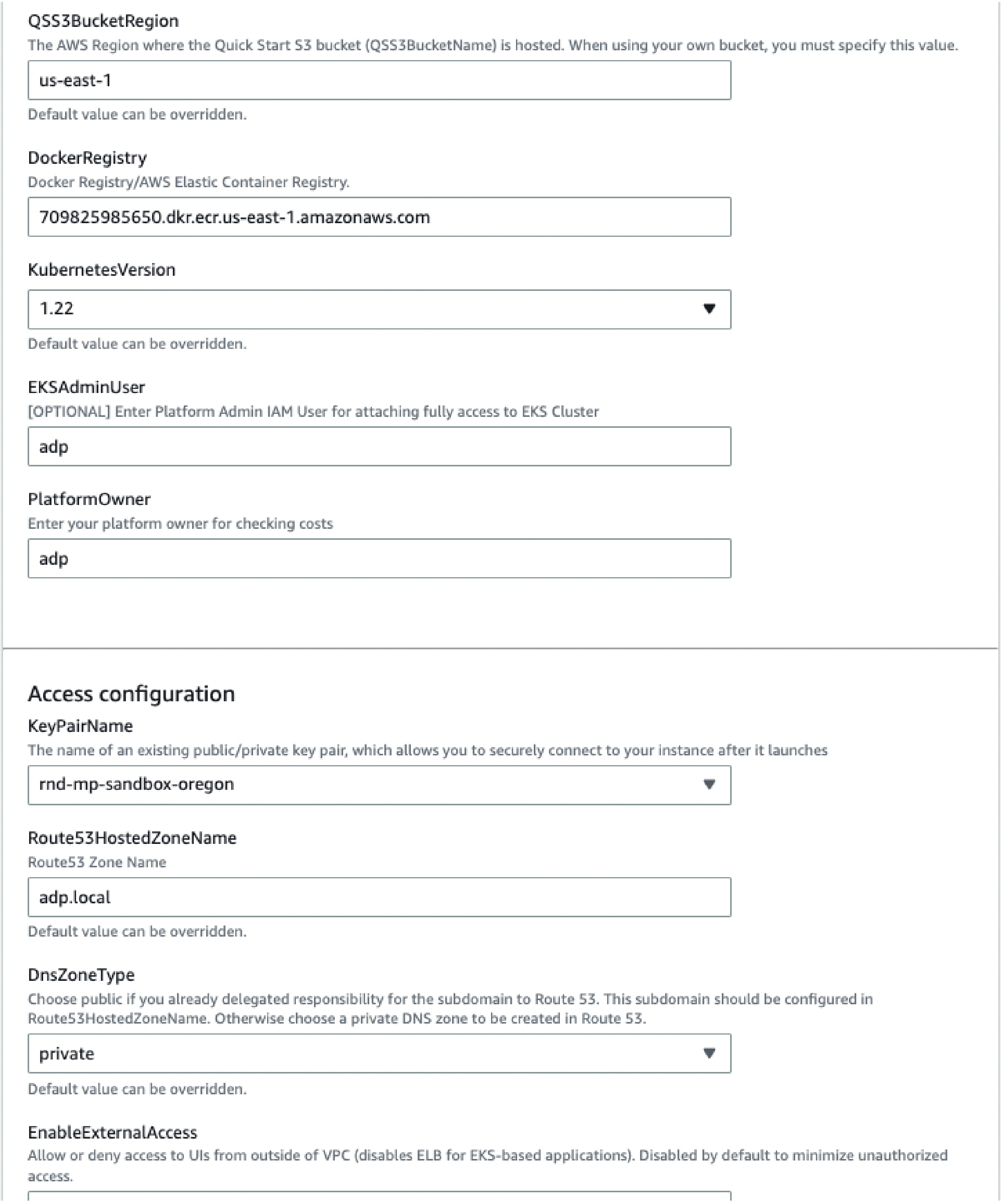
Default value can be overridden.

QSS3KeyPrefix

S3 key prefix for the Quick Start assets. Quick Start key prefix can include numbers, lowercase letters, hyphens (-), and must have forward slash (/) at the end.

quickstart-amazon-eks-v-3-2-0/

Default value can be overridden.



QSS3BucketRegion

The AWS Region where the Quick Start S3 bucket (QSS3BucketName) is hosted. When using your own bucket, you must specify this value.

us-east-1

Default value can be overridden.

DockerRegistry

Docker Registry/AWS Elastic Container Registry.

709825985650.dkr.ecr.us-east-1.amazonaws.com

KubernetesVersion

1.22 ▼

Default value can be overridden.

EKSAdminUser

[OPTIONAL] Enter Platform Admin IAM User for attaching fully access to EKS Cluster

adp

PlatformOwner

Enter your platform owner for checking costs

adp

Access configuration

KeyPairName

The name of an existing public/private key pair, which allows you to securely connect to your instance after it launches

rnd-mp-sandbox-oregon ▼

Route53HostedZoneName

Route53 Zone Name

adp.local

Default value can be overridden.

DnsZoneType

Choose public if you already delegated responsibility for the subdomain to Route 53. This subdomain should be configured in Route53HostedZoneName. Otherwise choose a private DNS zone to be created in Route 53.

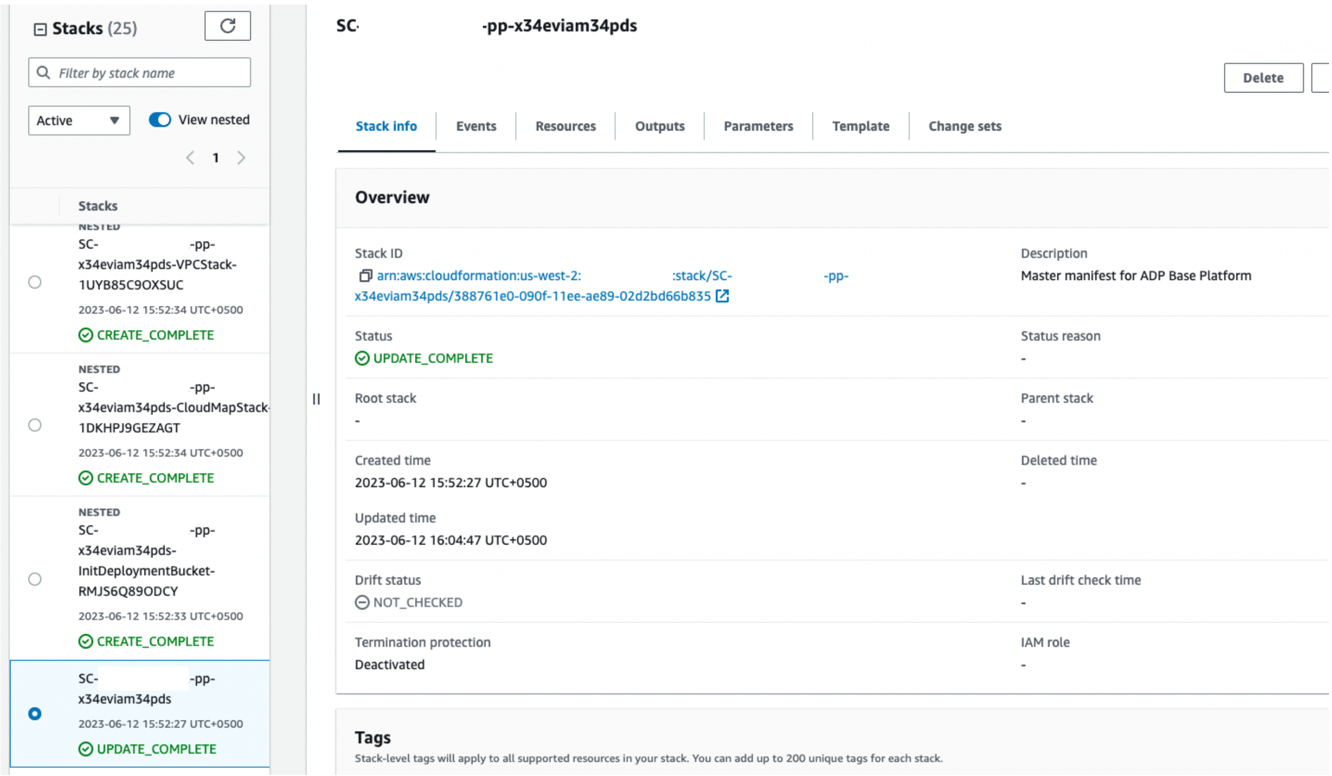
private ▼

Default value can be overridden.

EnableExternalAccess

Allow or deny access to UIs from outside of VPC (disables ELB for EKS-based applications). Disabled by default to minimize unauthorized access.

The four parameters above are enough to run the platform from scratch in any AWS account. All other parameters used in the platform can be left as is. Once the base platform starts provisioning in CloudFormation, all steps will be in progress and on completion it will look like:



NESTED
SC- -pp-x34eviam34pds-VPCStack-1UYB85C9OXSUC
2023-06-12 15:52:34 UTC+0500
✓ CREATE_COMPLETE

NESTED
SC- -pp-x34eviam34pds-CloudMapStack-1DKHPJ9GEZAGT
2023-06-12 15:52:34 UTC+0500
✓ CREATE_COMPLETE

NESTED
SC- -pp-x34eviam34pds-InitDeploymentBucket-RMJS6Q89ODCY
2023-06-12 15:52:33 UTC+0500
✓ CREATE_COMPLETE

● SC- -pp-x34eviam34pds
2023-06-12 15:52:27 UTC+0500
✓ UPDATE_COMPLETE

SC- -pp-x34eviam34pds

Overview

Stack ID arn:aws:cloudformation:us-west-2: :stack/SC- -pp-x34eviam34pds/388761e0-090f-11ee-ae89-02d2bd66b835	Description Master manifest for ADP Base Platform
Status ✓ UPDATE_COMPLETE	Status reason -
Root stack -	Parent stack -
Created time 2023-06-12 15:52:27 UTC+0500	Deleted time -
Updated time 2023-06-12 16:04:47 UTC+0500	
Drift status ⊖ NOT_CHECKED	Last drift check time -
Termination protection Deactivated	IAM role -

Tags

Stack-level tags will apply to all supported resources in your stack. You can add up to 200 unique tags for each stack.

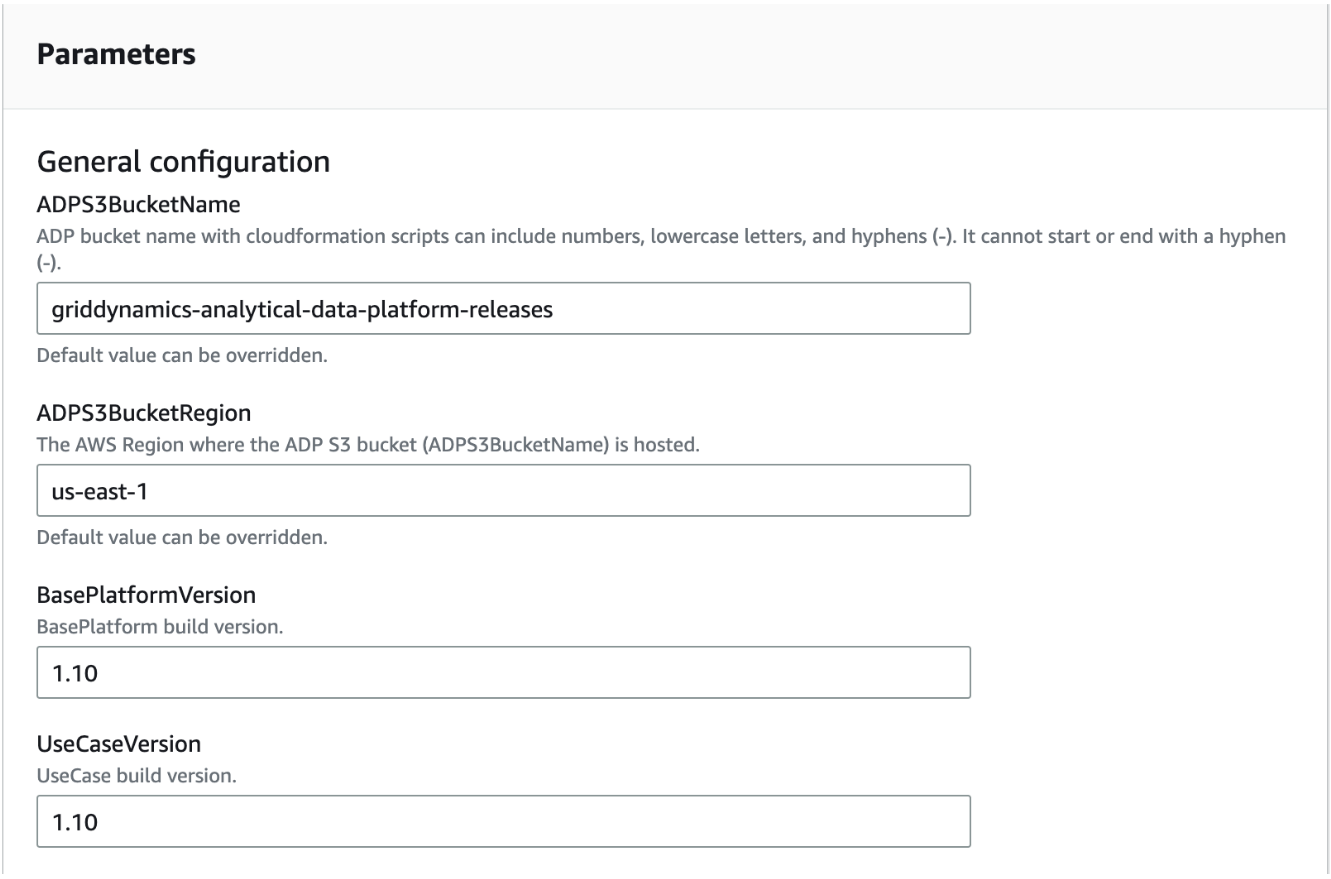
Once the base platform is up and running, any capability can be deployed on top.

Notice:

Many of our clients have base platform failing at the very beginning due to the VPC limit in AWS. Please ensure there is at least one VPC network could be created before running the base platform.

Use cases

Use cases provisions the following abilities: Batch capability, Streaming capability, Data Quality capability, Data Governance capability, Dashboard capability, ML capability: Visual Attributes, ML capability: Promotion Planning, ML capability: ML Operations. Use cases can be provisioned on top of the base platform without needing to define any parameters:



Parameters

General configuration

ADPS3BucketName

ADP bucket name with cloudformation scripts can include numbers, lowercase letters, and hyphens (-). It cannot start or end with a hyphen (-).

griddynamics-analytical-data-platform-releases

Default value can be overridden.

ADPS3BucketRegion

The AWS Region where the ADP S3 bucket (ADPS3BucketName) is hosted.

us-east-1

Default value can be overridden.

BasePlatformVersion

BasePlatform build version.

1.10

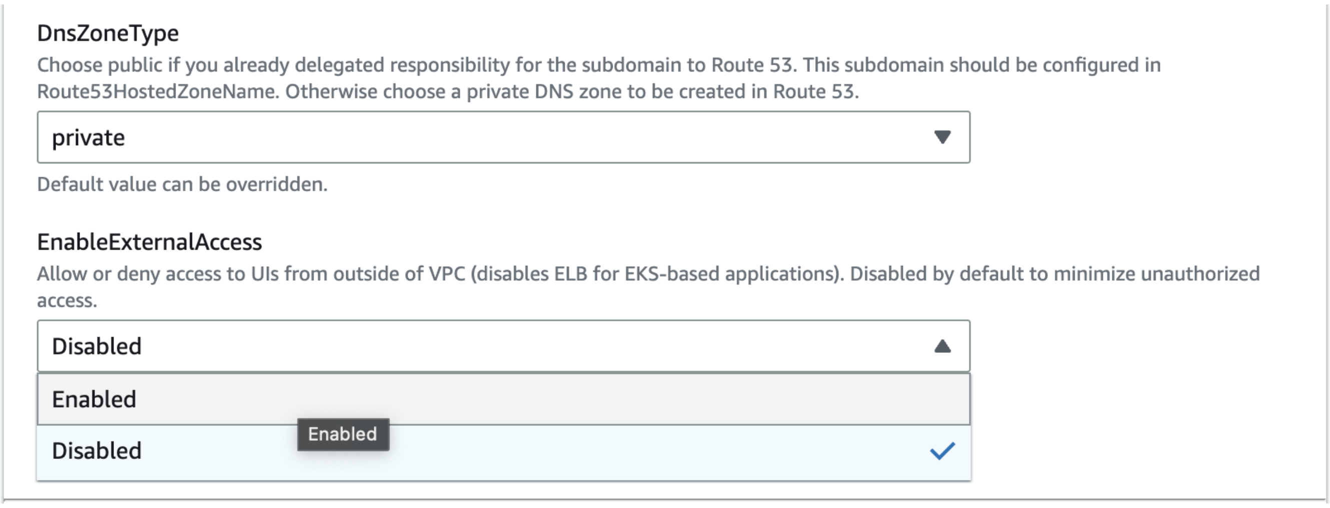
UseCaseVersion

UseCase build version.

1.10

In the use cases there are two URLs: one is active inside the VPN network, the other ELB (access can be granted for the world wide internet) is active only if it's enabled. Also this item should be included in the base platform.

EnableExternalAccess is where it can be enabled.



DnsZoneType

Choose public if you already delegated responsibility for the subdomain to Route 53. This subdomain should be configured in Route53HostedZoneName. Otherwise choose a private DNS zone to be created in Route 53.

private ▼

Default value can be overridden.

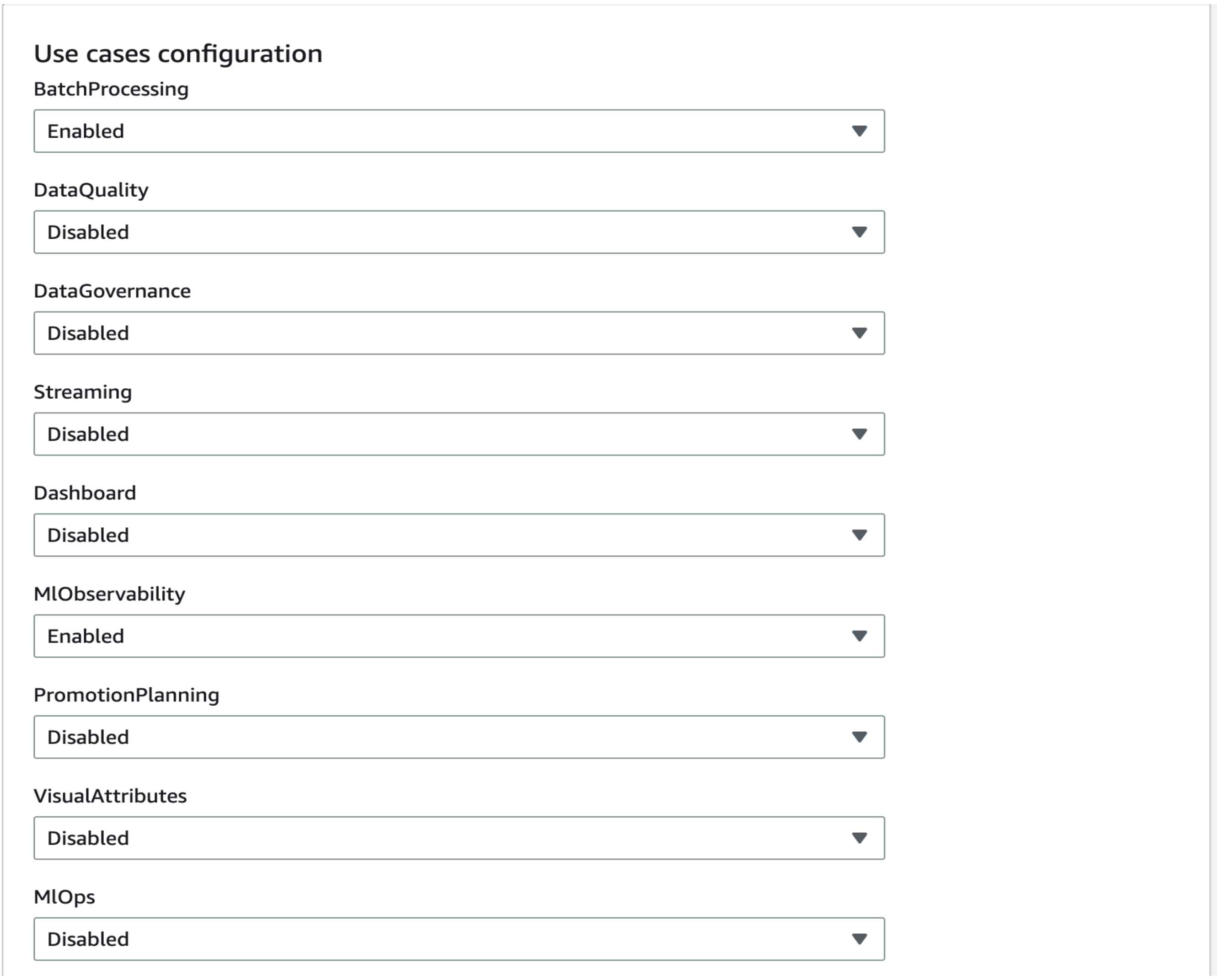
EnableExternalAccess

Allow or deny access to UIs from outside of VPC (disables ELB for EKS-based applications). Disabled by default to minimize unauthorized access.

Disabled ▲

We don't recommend exposing to the public network the services, it could be used for a demo purpose for a limited time period.

In "Use cases configuration" you choose which capabilities to include:



Use cases configuration

BatchProcessing: Enabled

DataQuality: Disabled

DataGovernance: Disabled

Streaming: Disabled

Dashboard: Disabled

MlObservability: Enabled

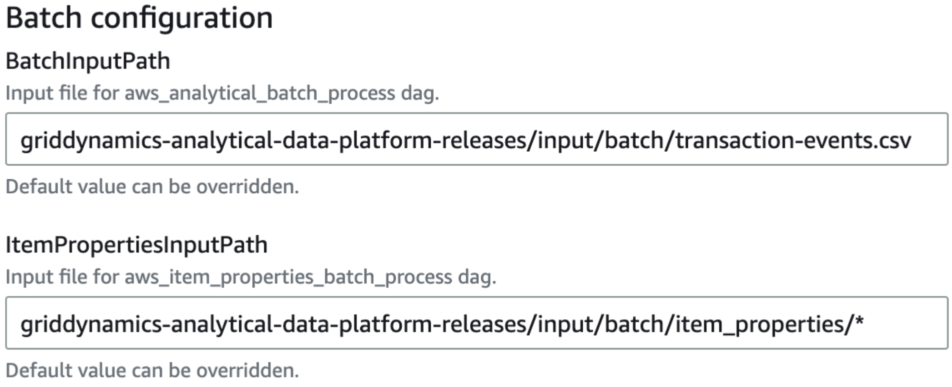
PromotionPlanning: Disabled

VisualAttributes: Disabled

MlOps: Disabled

Batch analytics

Batch analytics provisions the following components: EMR for batch analytics, Apache Airflow to orchestrate the jobs, and data lake on top of S3. Batch capability can be provisioned on top of the base platform without needing to define any parameters:

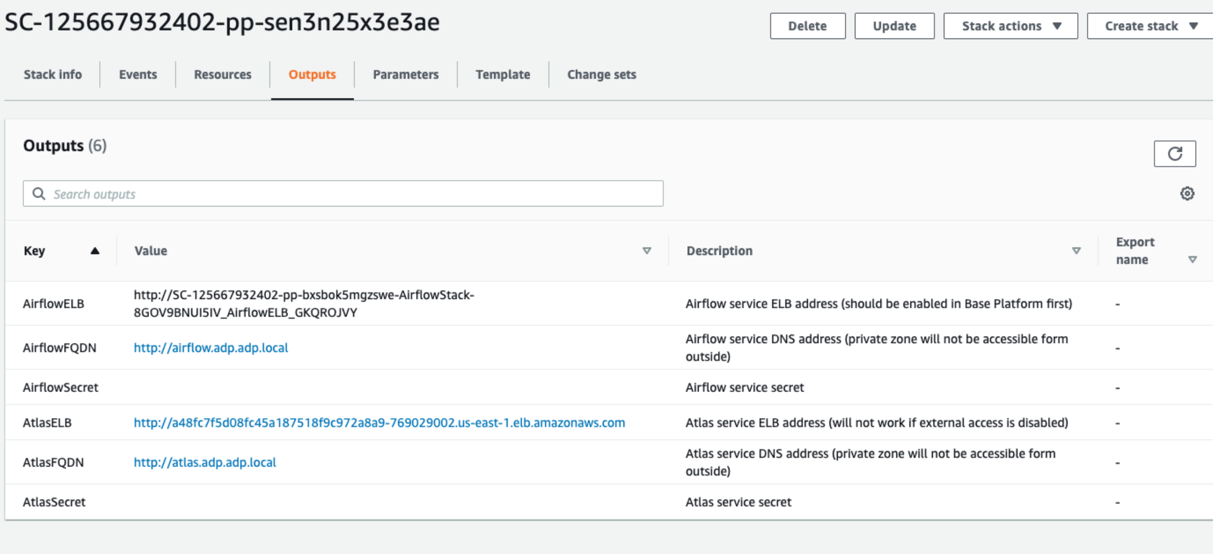


Batch configuration

BatchInputPath
Input file for aws_analytical_batch_process dag.
griddynamics-analytical-data-platform-releases/input/batch/transaction-events.csv
Default value can be overridden.

ItemPropertiesInputPath
Input file for aws_item_properties_batch_process dag.
griddynamics-analytical-data-platform-releases/input/batch/item_properties/*
Default value can be overridden.

BatchInputPath and ItemPropertiesInputPath are used in demo code that is running on top of the platform. Once the batch use case is up and running, demo Spark jobs can be run from the Apache Airflow UI. A link to the Apache Airflow UI will be available in CloudFormation in the deployed stack details:



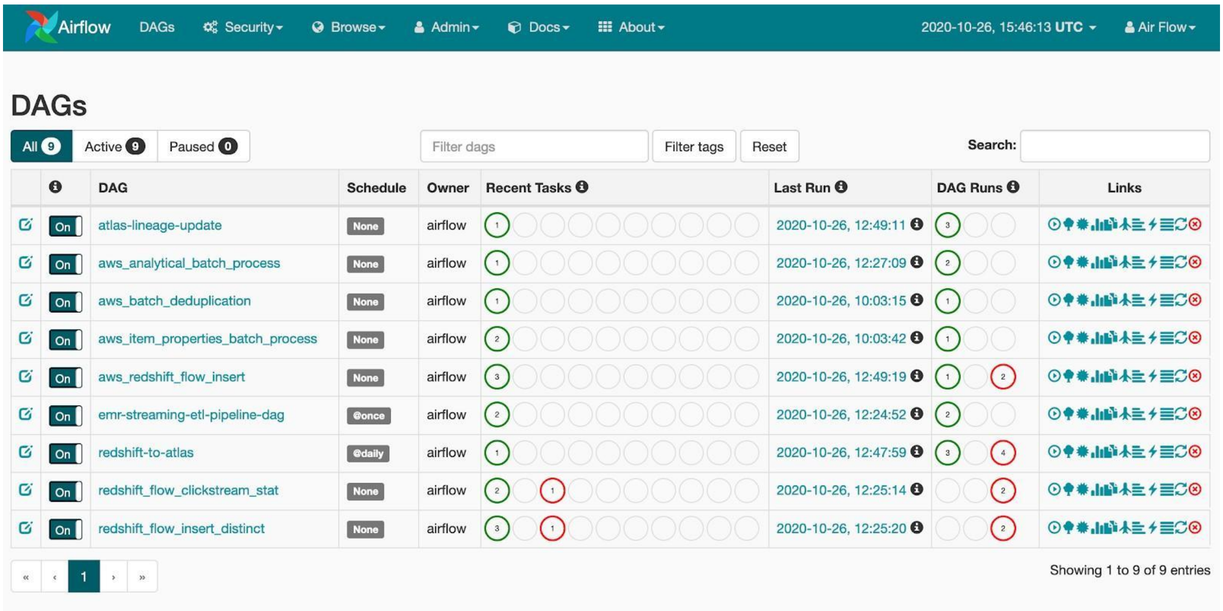
Outputs (6)

Key ▲	Value	Description	Export name
AirflowELB	http://SC-125667932402-pp-bxsbok5mgzswe-AirflowStack-8GOV9BNUI5IV_AirflowELB_GKQROJVY	Airflow service ELB address (should be enabled in Base Platform first)	-
AirflowFQDN	http://airflow.adp.adp.local	Airflow service DNS address (private zone will not be accessible form outside)	-
AirflowSecret		Airflow service secret	-
AtlasELB	http://a48fc7f5d08fc45a187518f9c972a8a9-769029002.us-east-1.elb.amazonaws.com	Atlas service ELB address (will not work if external access is disabled)	-
AtlasFQDN	http://atlas.adp.adp.local	Atlas service DNS address (private zone will not be accessible form outside)	-
AtlasSecret		Atlas service secret	-

In the image above there are two Airflow URLs: one is active inside the VPN network, the other (AirflowELB) is active only if it’s enabled in batch or streaming capability. EnableExternalAccess is where it can be enabled.

We don’t recommend exposing to the public network the services, it could be used for a demo purpose for a limited time period.

Once the batch capability is up and running you can open Apache Airflow UI or EMR and check flows running. There are several batch and streaming jobs which are deployed along with capability:



DAGs

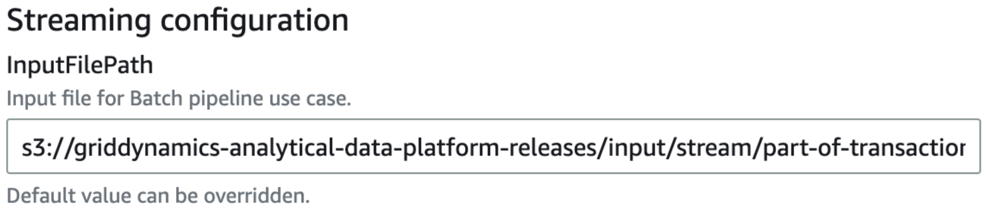
		DAG	Schedule	Owner	Recent Tasks	Last Run	DAG Runs	Links
	On	atlas-lineage-update	None	airflow	1	2020-10-26, 12:49:11	3	
	On	aws_analytical_batch_process	None	airflow	1	2020-10-26, 12:27:09	2	
	On	aws_batch_deduplication	None	airflow	1	2020-10-26, 10:03:15	1	
	On	aws_item_properties_batch_process	None	airflow	2	2020-10-26, 10:03:42	1	
	On	aws_redshift_flow_insert	None	airflow	3	2020-10-26, 12:49:19	1 2	
	On	emr-streaming-etl-pipeline-dag	@once	airflow	2	2020-10-26, 12:24:52	2	
	On	redshift-to-atlas	@daily	airflow	1	2020-10-26, 12:47:59	3 4	
	On	redshift_flow_clickstream_stat	None	airflow	2 1	2020-10-26, 12:25:14	2	
	On	redshift_flow_insert_distinct	None	airflow	3 1	2020-10-26, 12:25:20	2	

« ‹ 1 › »

Showing 1 to 9 of 9 entries

Streaming analytics

The streaming analytics capability targets real time scenarios including real time analytics and streaming fraud detection. For the streaming analytics capability EMR, Kinesis, Apache Airflow, and S3 are provisioned. There are also streaming jobs that are orchestrated by Apache Airflow and can be used for example or demo purposes. The use case can be provisioned with zero parameters specified



Streaming configuration

InputFilePath

Input file for Batch pipeline use case.

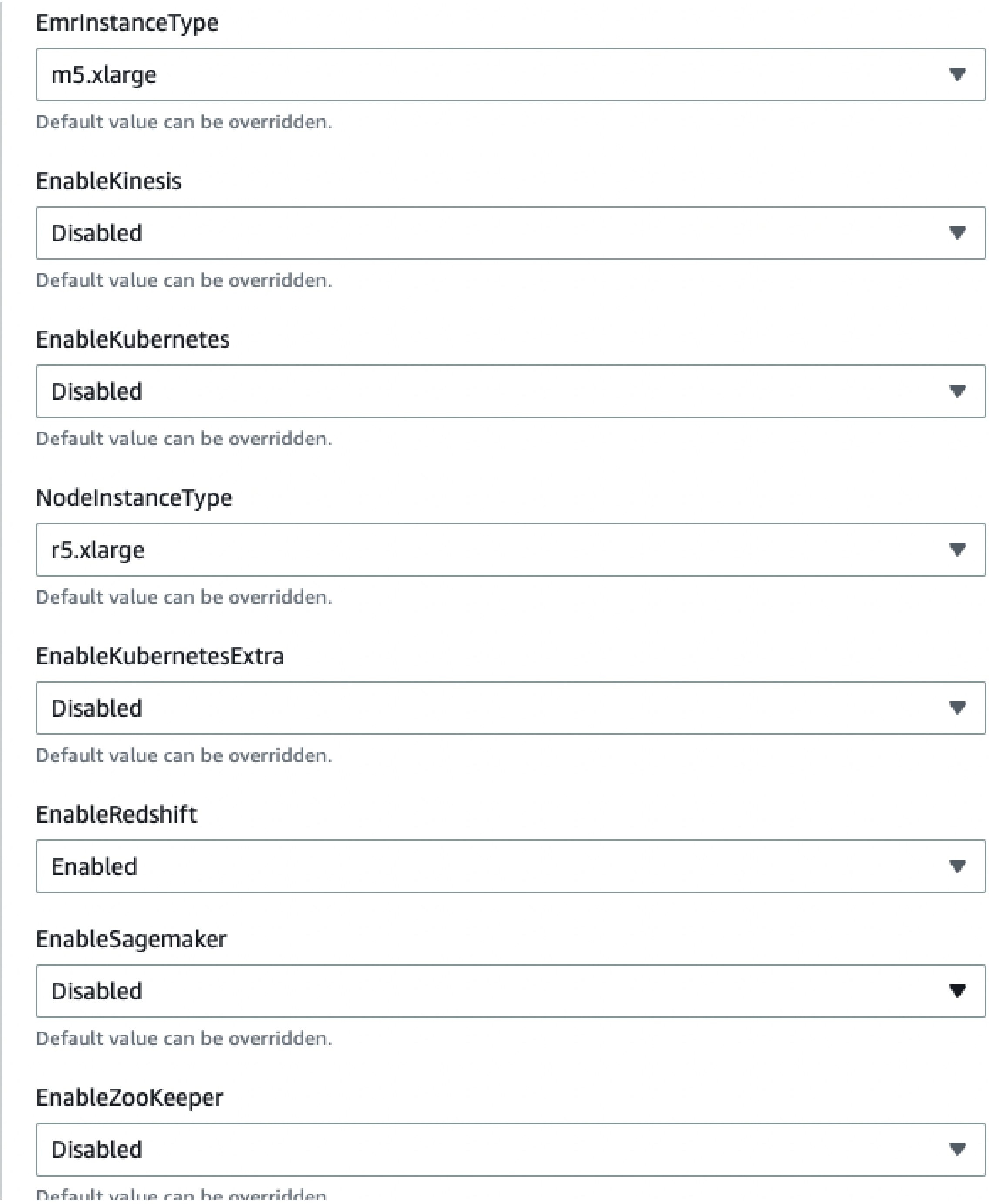
s3://griddynamics-analytical-data-platform-releases/input/stream/part-of-transactior

Default value can be overridden.

InputFilePath is used for demo applications and is available with the use case. The rest of the configurations are system ones and should be left unchanged. In addition to this, infrastructure applications are also deployed. There are several Spark batch and streaming applications along with Airflow DAGs deployed for orchestration purposes.

Enterprise data warehouse

The analytical data platform leverages Redshift as an enterprise data warehouse solution. The platform doesn’t provide a dedicated capability to deploy Redshift as an independent capability - it comes with batch, streaming, or ML use cases. Typically data platforms start with data lake and batch or streaming processing before moving onto EDW. In cases where EDW needs to be deployed without batch, streaming, or ML use cases, it can be deployed directly by enabling it in the base platform:



EmrInstanceType

m5.xlarge

Default value can be overridden.

EnableKinesis

Disabled

Default value can be overridden.

EnableKubernetes

Disabled

Default value can be overridden.

NodeInstanceType

r5.xlarge

Default value can be overridden.

EnableKubernetesExtra

Disabled

Default value can be overridden.

EnableRedshift

Enabled

EnableSagemaker

Disabled

Default value can be overridden.

EnableZooKeeper

Disabled

Default value can be overridden.

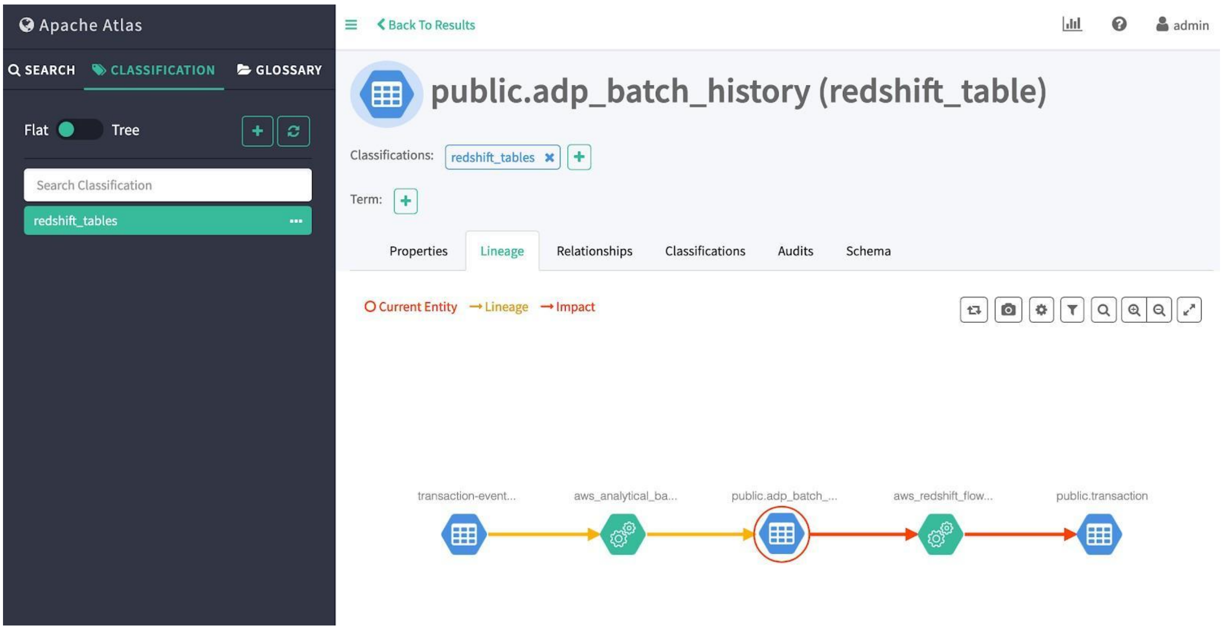
All other services are disabled and will be deployed by use cases directly.

Data governance

One of the key features of the analytical data platform is data governance integration. The platform provides tooling to setup data governance in a process similar to CI/CD:

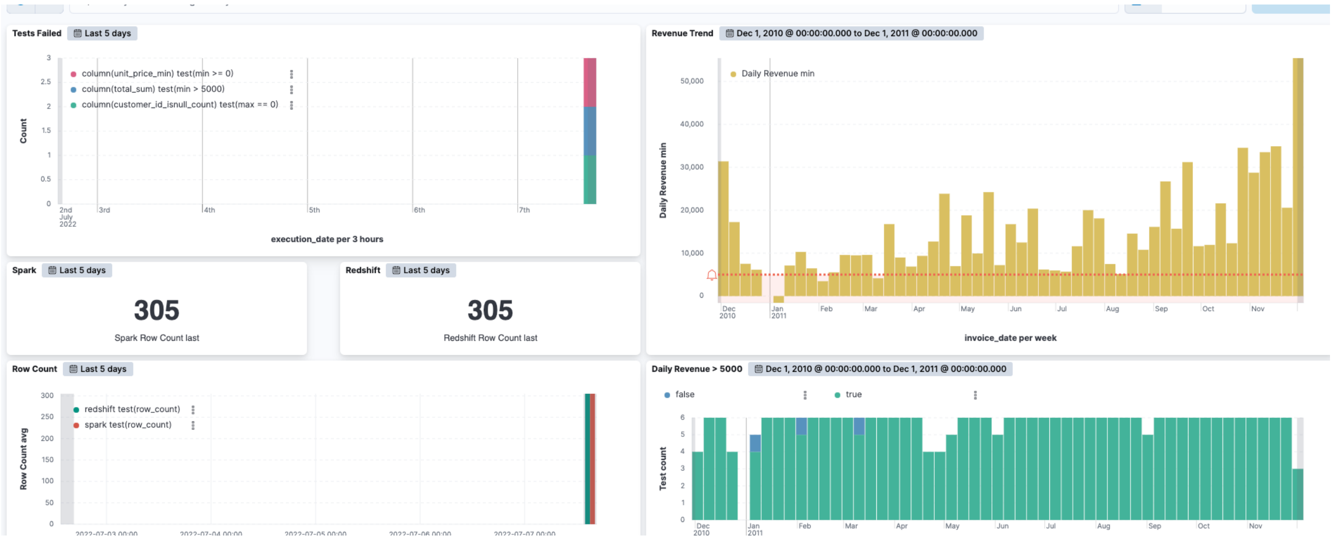
- Apache Airflow is used for workflow orchestration
- Apache Atlas is used for data catalog and data lineage
- Data quality is a custom Grid Dynamics solution

Apache Atlas builds the data catalog over all data in S3 and Redshift. Integration of Atlas and Airflow brings lineage information about all flows - Atlas provides information about what source datasets are used in the final dataset. Integration is done as a custom plugin for Airflow, which sends lineage information to Atlas where it’s visualized:



Data quality is provided by Grid Dynamics' custom solution, which helps to:

1. Run data monitoring checks
2. Identify anomalies in the data
3. Run complex data quality rules
4. Check data in various data sources like S3, Redshift, Snowflake, Teradata, and others
5. Build dashboards on top of data checks
6. Send alerts Kibana dashboard:



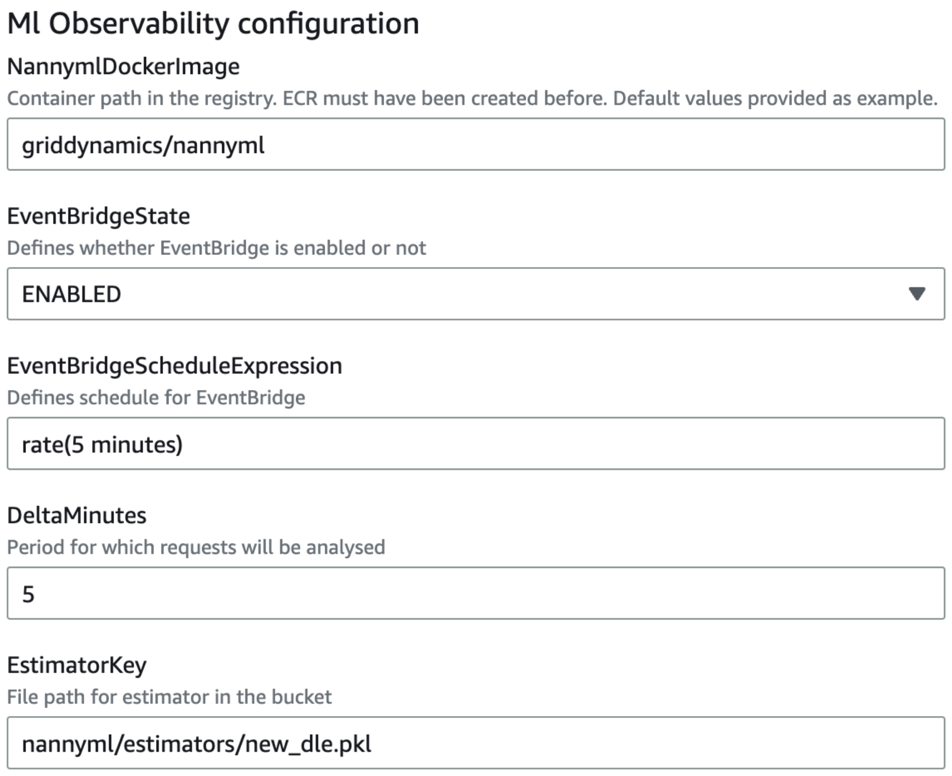
Data governance provisioning is similar to the use cases detailed above.

There are two user input parameters responsible for external access, which obviously should be private by default. The rest of the configuration is maintained by CloudFormation. Once the platform is up and running, it provides access to Apache Atlas and data quality only for VPN restricted networks. To enable world wide access please enable EnableExternalAccess in use cases configuration and base platform.

ML observability

ML Observability is an extension to ML platform aimed to help with definition of ML models' monitoring scenarios, drifts in datasets and ML models' predictions.

ML Observability provisions the following components: Sagemaker Notebook and S3 buckets. ML Observability capability can be provisioned on top of the base platform without needing to define any parameters:



Ml Observability configuration

NannymlDockerImage
Container path in the registry. ECR must have been created before. Default values provided as example.
griddynamics/nannyml

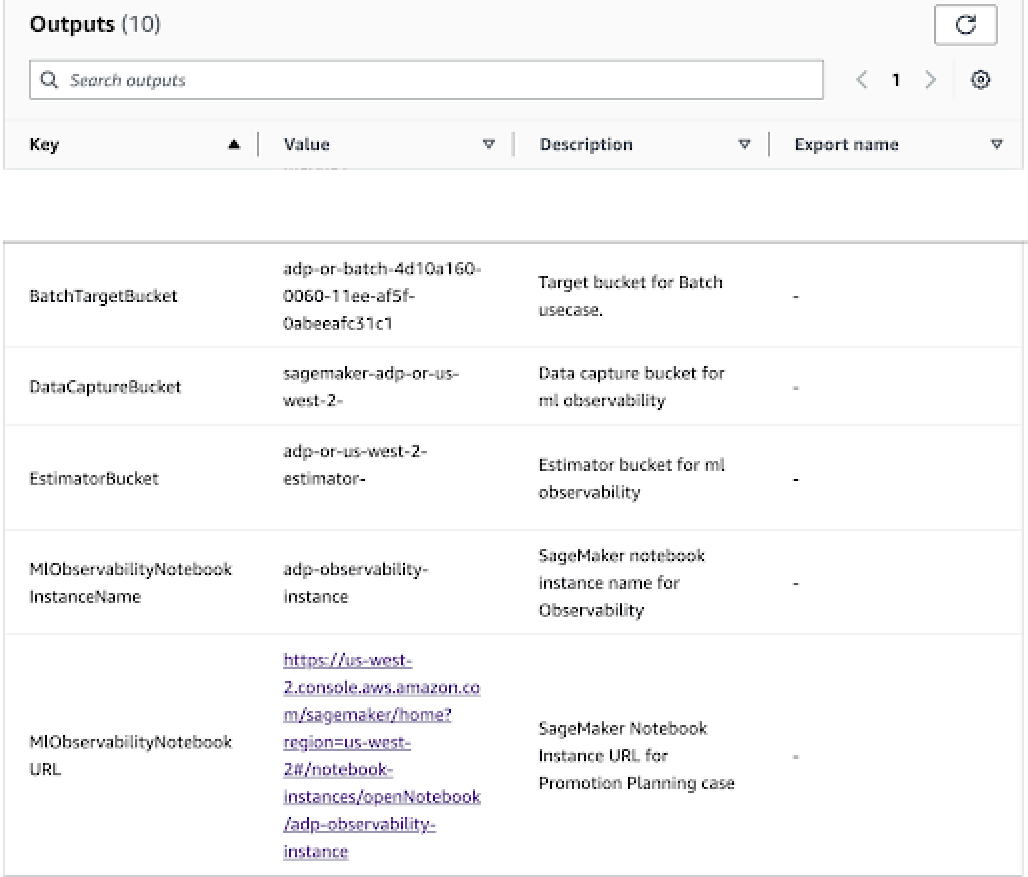
EventBridgeState
Defines whether EventBridge is enabled or not
ENABLED ▼

EventBridgeScheduleExpression
Defines schedule for EventBridge
rate(5 minutes)

DeltaMinutes
Period for which requests will be analysed
5

EstimatorKey
File path for estimator in the bucket
nannyml/estimators/new_dle.pkl

In the outputs of the stack there will be a link to the created Sagemaker notebook and s3 buckets.



Outputs (10)

Key	Value	Description	Export name
BatchTargetBucket	adp-or-batch-4d10a160-0060-11ee-af5f-0abeeafc31c1	Target bucket for Batch usecase.	-
DataCaptureBucket	sagemaker-adp-or-us-west-2-	Data capture bucket for ml observability	-
EstimatorBucket	adp-or-us-west-2-estimator-	Estimator bucket for ml observability	-
MlObservabilityNotebookInstanceName	adp-observability-instance	SageMaker notebook instance name for Observability	-
MlObservabilityNotebookURL	https://us-west-2.console.aws.amazon.com/sagemaker/home?region=us-west-2#/notebook-instances/openNotebook/adp-observability-instance	SageMaker Notebook Instance URL for Promotion Planning case	-

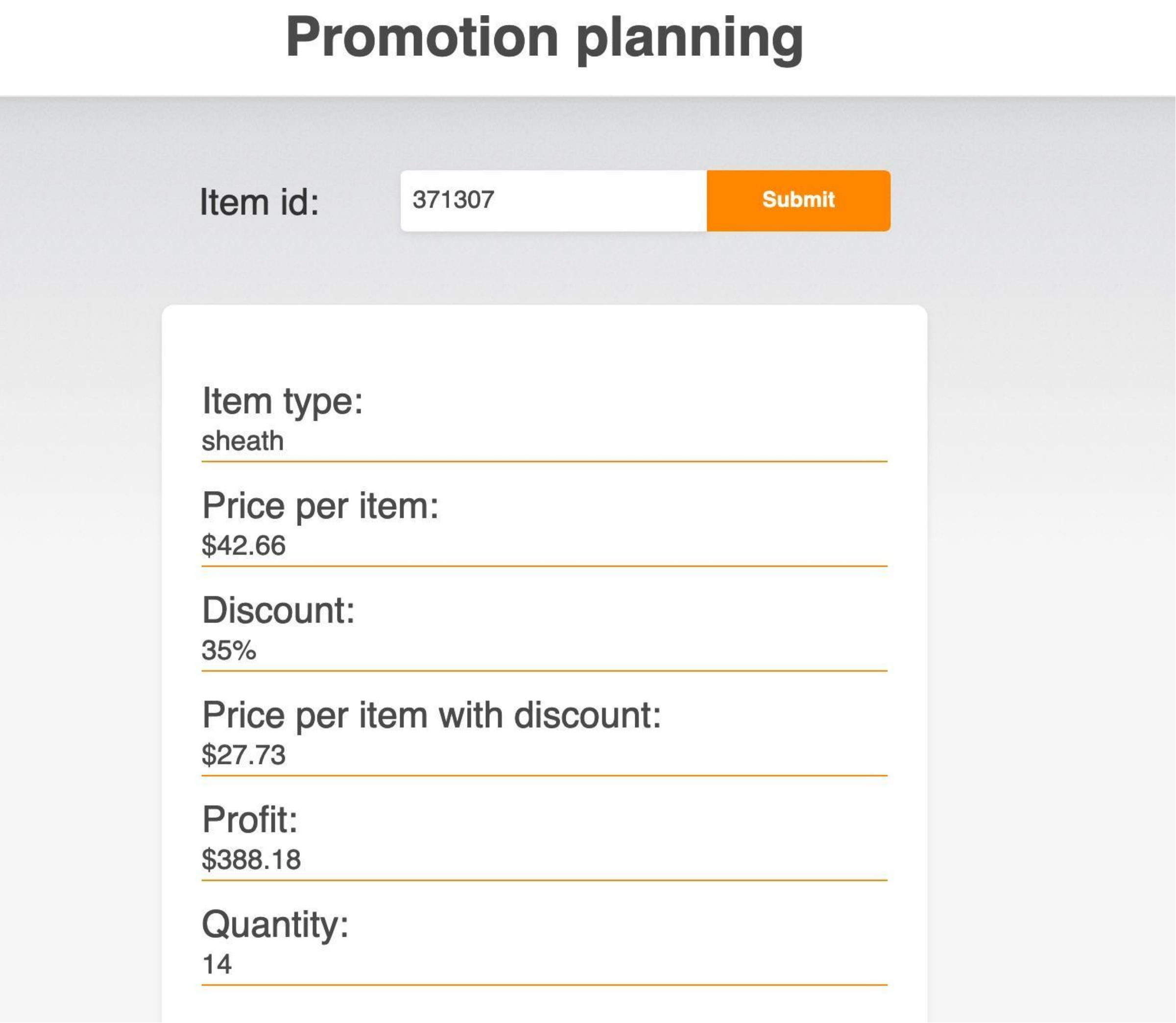
Important!

1. Before you proceed with cloudformation template installation, pull the image **NannymlDockerImage** from Marketplace, create ECR in your AWS account and push it there. Change the path to yours ECR in **NannymlDockerImage** when launch/update use cases.

Promotion planning

Enabling MLOps with the data platform and providing an easy way to release models to production is always a cumbersome process. To simplify ML models development and management, it is helpful to provide proper integration with the data lake and enterprise data warehouse.

There are several use cases we've added on top of the ML platform for demo purposes. Promotion planning is one of these. The promotion planning use case creates the ML model, which creates the discount recommendations.



Promotion planning

Item id: 371307

Item type:
sheath

Price per item:
$42.66

Discount:
35%

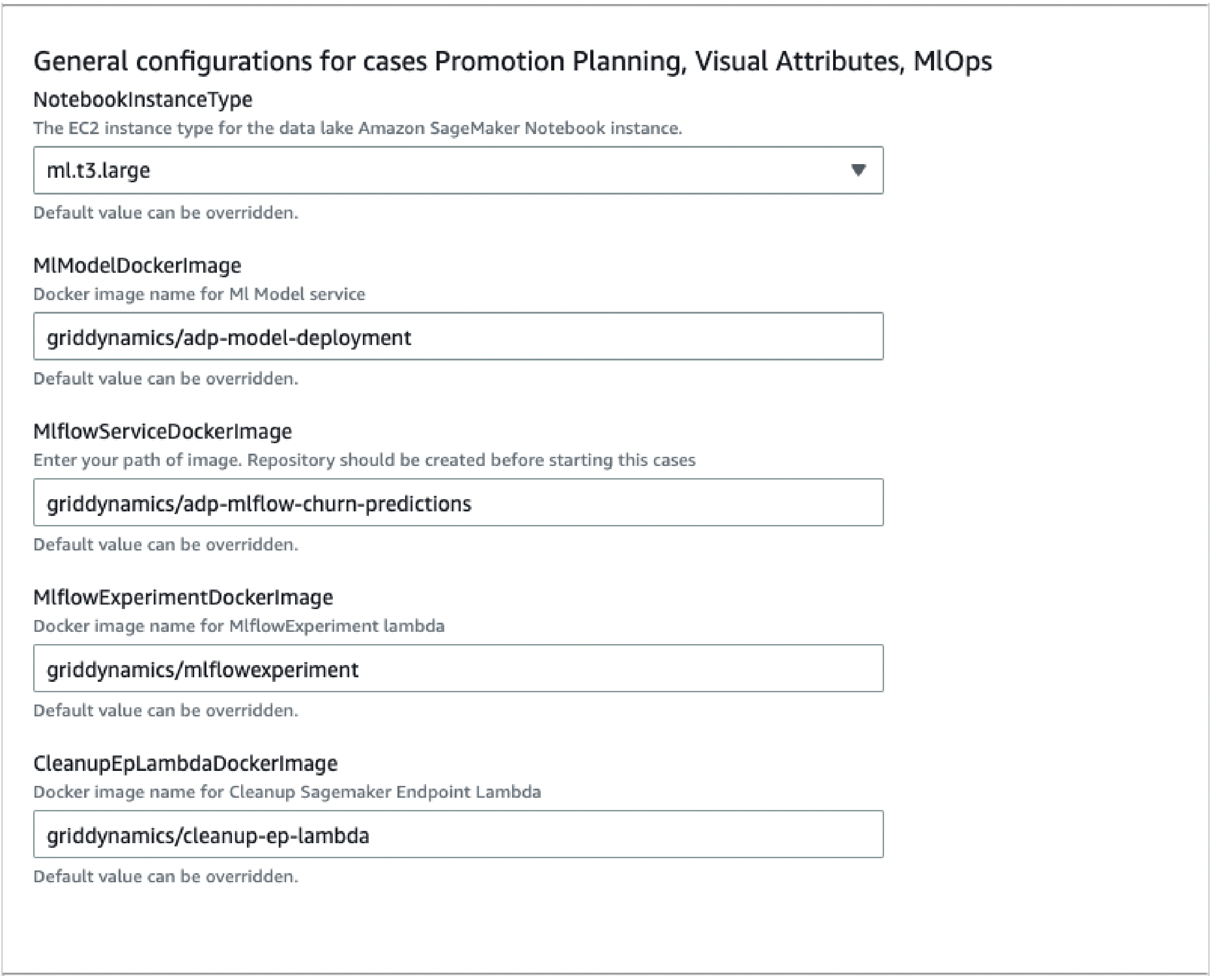
Price per item with discount:
$27.73

Profit:
$388.18

Quantity:
14

Recommendations are based on sales history information available in the data platform.

Promotion planning provisions Sagemaker, creates notebook instances, and loads an already prepared Jupyter notebook. Data required for the model is available at S3 bucket adp-rnd-ml-datasets prepared by our team. The model will be stored in a private bucket that is provisioned by CloudFormation automation. Once a model is created, it also spins up a web UI to demonstrate the recommendation in action. Capability provisioning is straightforward:



General configurations for cases Promotion Planning, Visual Attributes, MlOps

NotebookInstanceType

The EC2 instance type for the data lake Amazon SageMaker Notebook instance.

ml.t3.large ▼

Default value can be overridden.

MlModelDockerImage

Docker image name for Ml Model service

griddynamics/adp-model-deployment

Default value can be overridden.

MlflowServiceDockerImage

Enter your path of image. Repository should be created before starting this cases

griddynamics/adp-mlflow-churn-predictions

Default value can be overridden.

MlflowExperimentDockerImage

Docker image name for MlflowExperiment lambda

griddynamics/mlflowexperiment

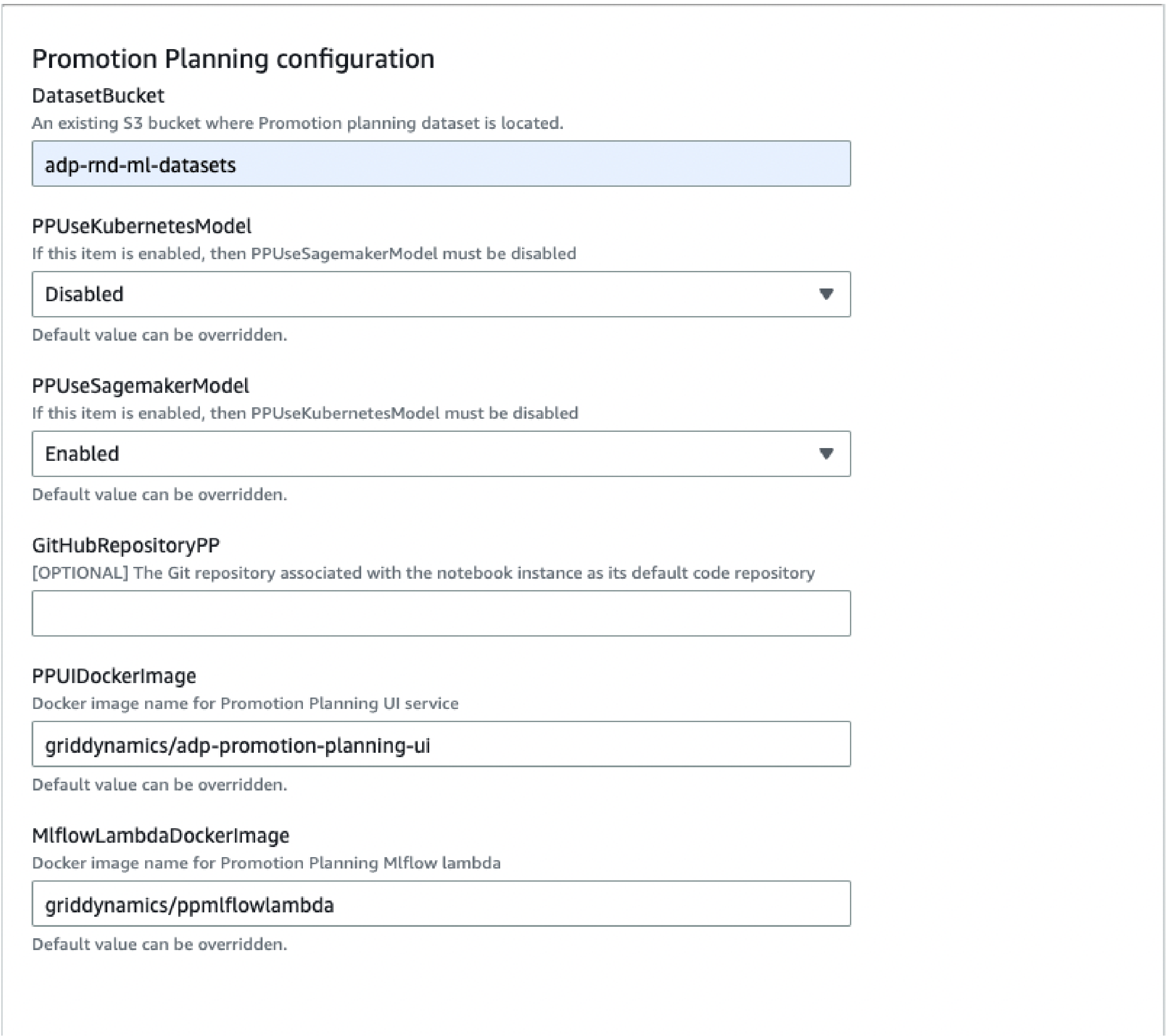
Default value can be overridden.

CleanupEpLambdaDockerImage

Docker image name for Cleanup Sagemaker Endpoint Lambda

griddynamics/cleanup-ep-lambda

Default value can be overridden.



Promotion Planning configuration

DatasetBucket
An existing S3 bucket where Promotion planning dataset is located.
adp-rnd-ml-datasets

PPUseKubernetesModel
If this item is enabled, then PPUseSagemakerModel must be disabled
Disabled ▼
Default value can be overridden.

PPUseSagemakerModel
If this item is enabled, then PPUseKubernetesModel must be disabled
Enabled ▼
Default value can be overridden.

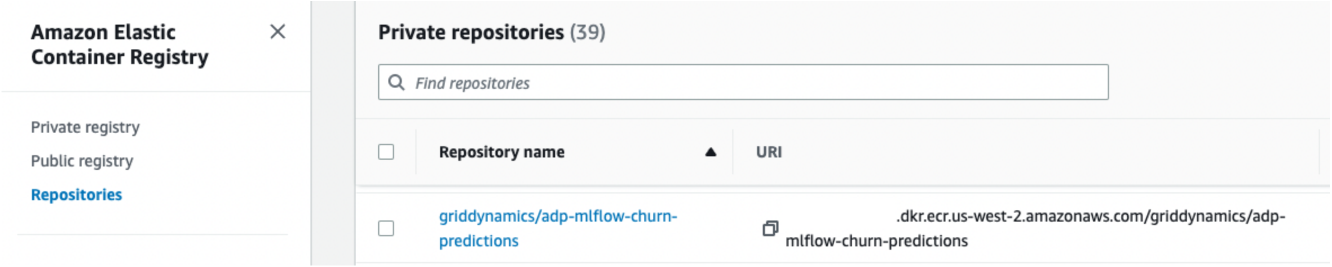
GitHubRepositoryPP
[OPTIONAL] The Git repository associated with the notebook instance as its default code repository

PPUIDockerImage
Docker image name for Promotion Planning UI service
griddynamics/adp-promotion-planning-ui
Default value can be overridden.

MlflowLambdaDockerImage
Docker image name for Promotion Planning Mlflow lambda
griddynamics/ppmlflowlambda
Default value can be overridden.

Important!

1. Before you proceed with cloudformation template installation, pull the images (**MlflowExperimentDockerImage**, **CleanupEpLambdaDockerImage**, **MlflowLambdaDockerImage**) from Marketplace, create ECR in your AWS account and push it there. Change the path to yours ECR in MlflowExperimentDockerImage, CleanupEpLambdaDockerImage, MlflowLambdaDockerImage when launch/update use cases
2. Before running this case **MlflowServiceImageRepository** should be created at AWS Account on Elastic Container Registry Resource. It's can be looks like this:



Private repositories (39)

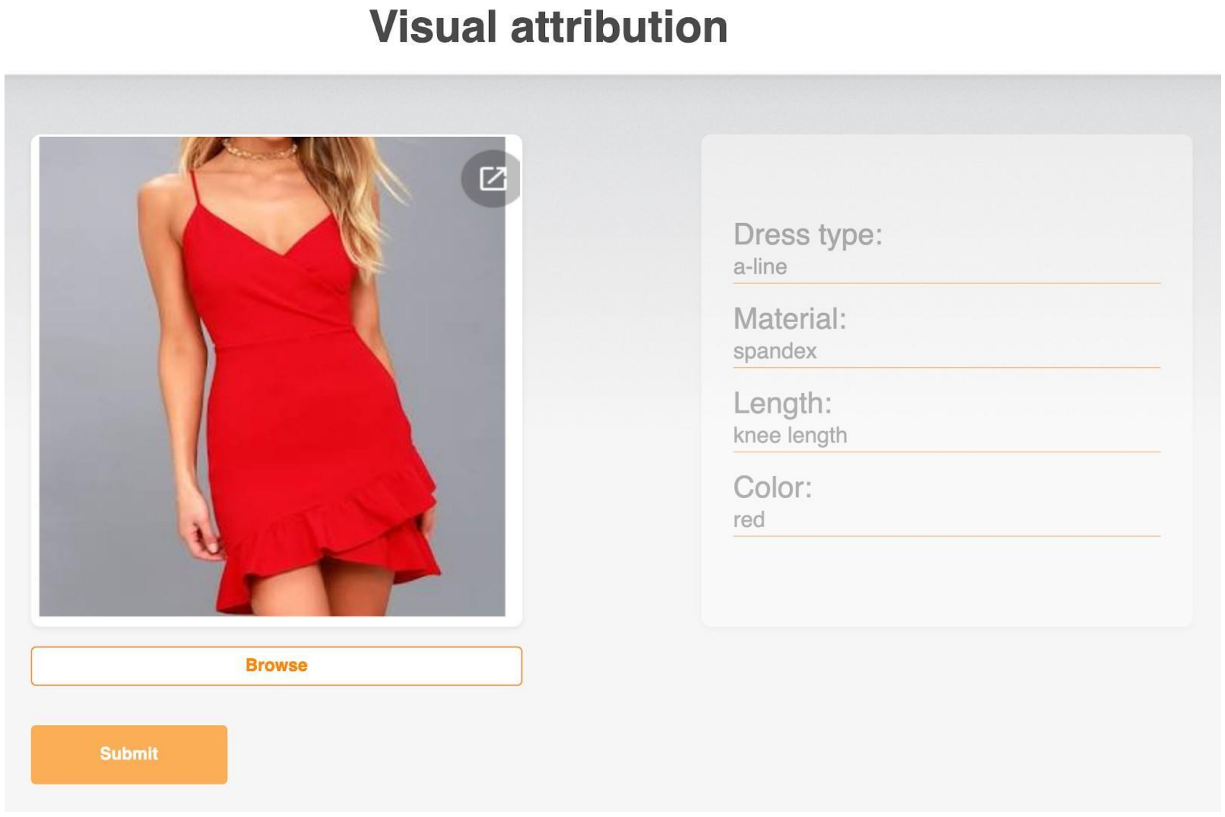
Find repositories

□	Repository name ▲	URI
□	griddynamics/adp-mlflow-churn-predictions	.dkr.ecr.us-west-2.amazonaws.com/griddynamics/adp-mlflow-churn-predictions

All variables are defined by CloudFormation automation. By default all components are not accessible outside a VPN. However, if needed access can be granted for the world wide internet, which can be done enable EnableExternalAccess in use case configuration and base platform

Visual attributes

The data platform can typically be operated with all types of data including transactional, operational, and visual data such as images. The visual attributes use case gets attributes from the image:



Visual attribution

Dress type:
a-line

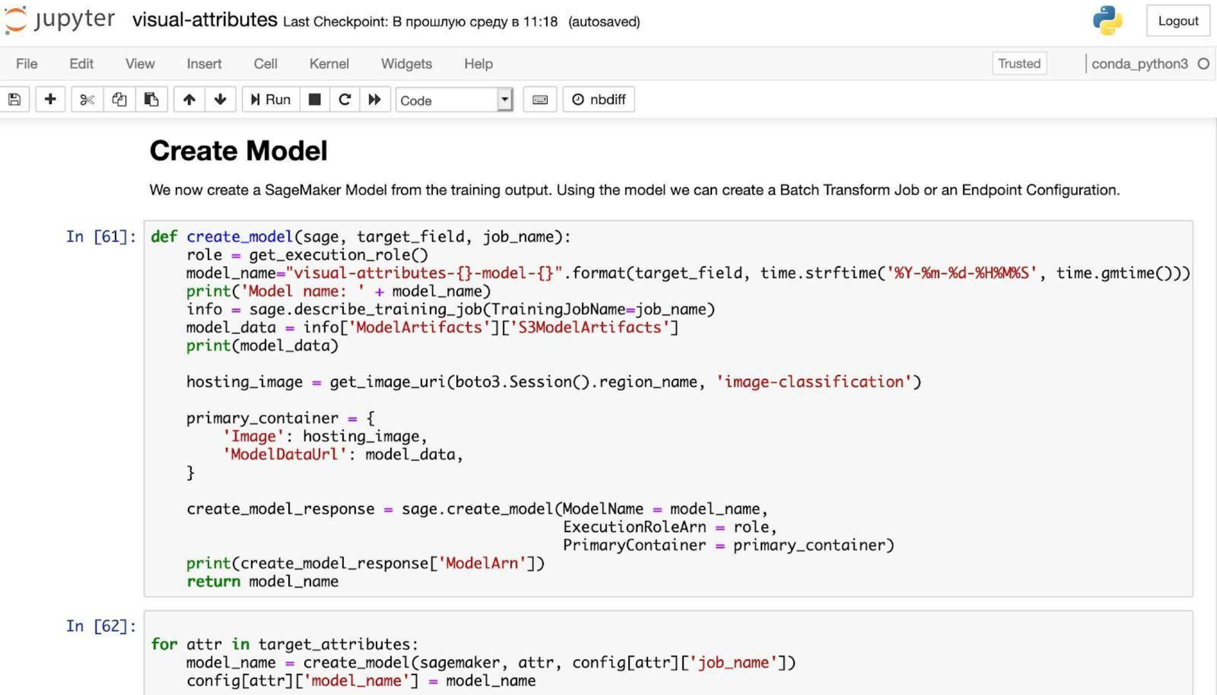
Material:
spandex

Length:
knee length

Color:
red

As an example we've taken a catalog of women's dresses and created a use case that identifies the type and color of the dress and helps to find a particular one in the catalog. Similar to the promotion planning use case above, links to both private and public links to the user interface will be available in the provisioned product details.

Source images for the model are also in the adp-rnd-ml-datasets S3 bucket. Jupyter notebook reads data directly and creates both the ML model and REST endpoint for the UI:



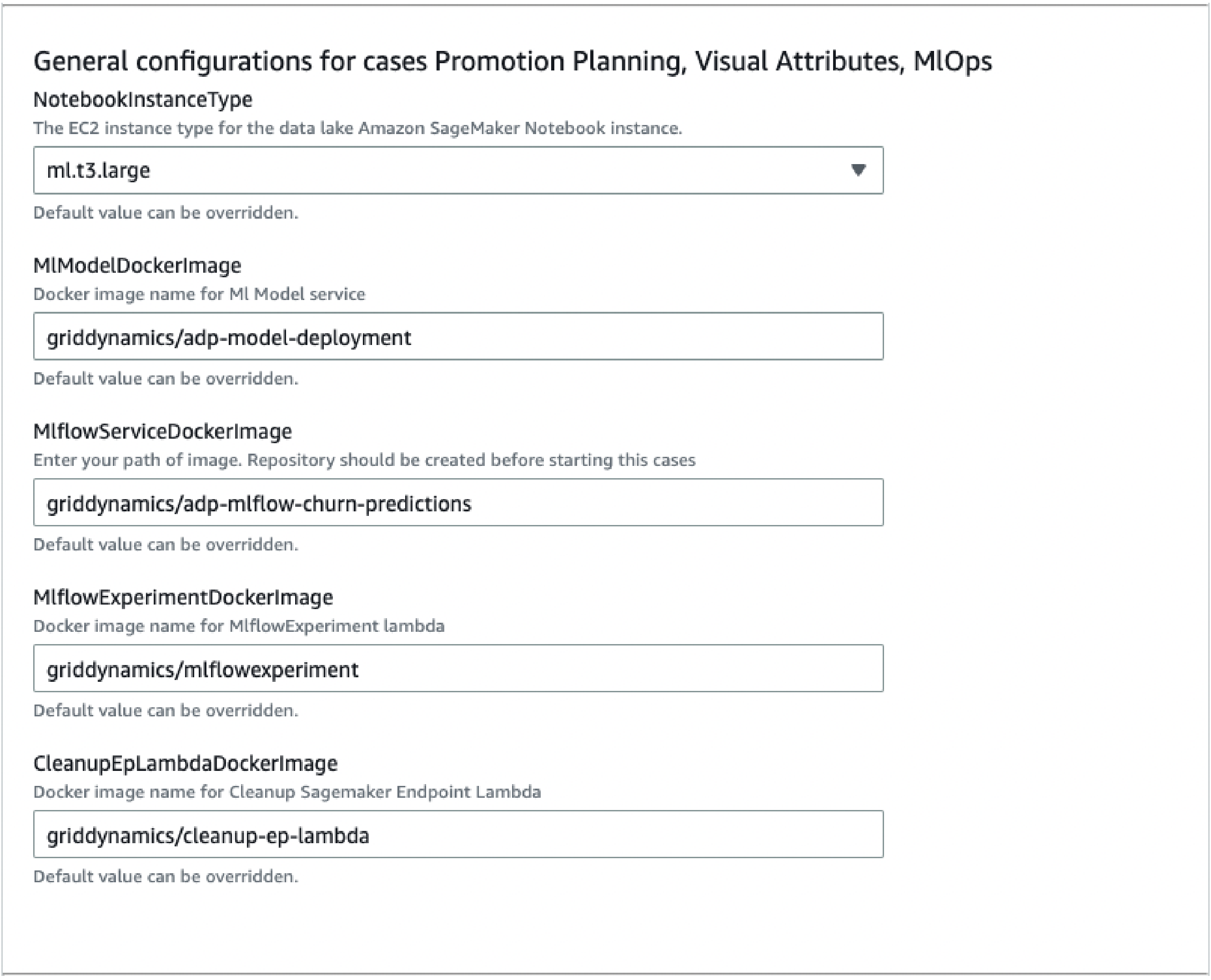
Create Model

We now create a SageMaker Model from the training output. Using the model we can create a Batch Transform Job or an Endpoint Configuration.

In [61]:
```
def create_model(sage, target_field, job_name):
    role = get_execution_role()
    model_name="visual-attributes-{}-model-{}".format(target_field, time.strftime('%Y-%m-%d-%H%M%S', time.gmtime()))
    print('Model name: ' + model_name)
    info = sage.describe_training_job(TrainingJobName=job_name)
    model_data = info['ModelArtifacts']['S3ModelArtifacts']
    print(model_data)

    hosting_image = get_image_uri(boto3.Session().region_name, 'image-classification')

    primary_container = {
        'Image': hosting_image,
        'ModelDataUrl': model_data,
    }

    create_model_response = sage.create_model(ModelName = model_name,
                                          ExecutionRoleArn = role,
                                          PrimaryContainer = primary_container)
    print(create_model_response['ModelArn'])
    return model_name
```

In [62]:
```
for attr in target_attributes:
    model_name = create_model(sagemaker, attr, config[attr]['job_name'])
    config[attr]['model_name'] = model_name
```

Visual attributes in Jupyter notebook are also created by CloudFormation automation. The ML engineer will just need to run the training and release process. Both visual attribute and promotion planning use cases help to understand and build the custom ML pipelines. Visual attributes provisioning works the same way:



General configurations for cases Promotion Planning, Visual Attributes, MlOps

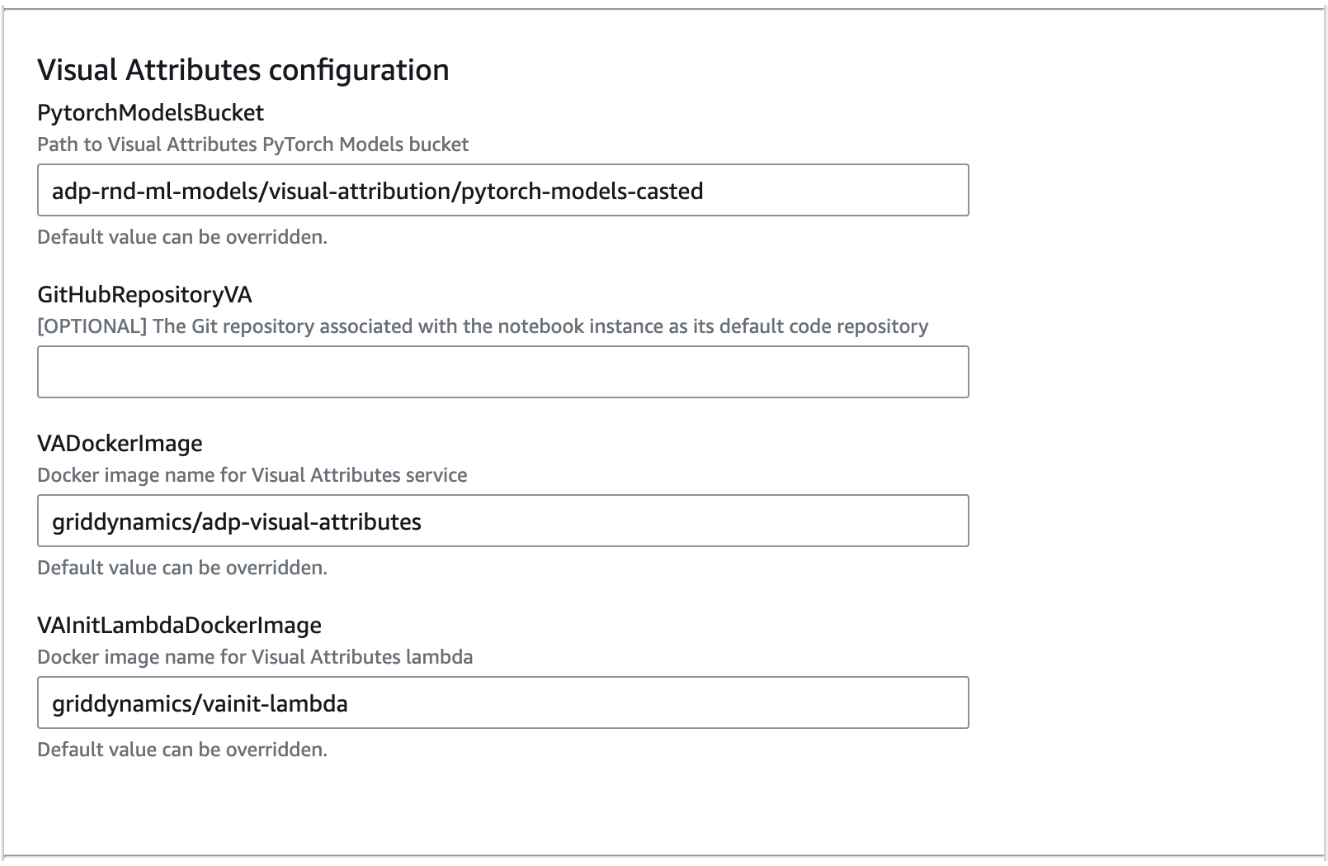
NotebookInstanceType
The EC2 instance type for the data lake Amazon SageMaker Notebook instance.
ml.t3.large ▼
Default value can be overridden.

MlModelDockerImage
Docker image name for Ml Model service
griddynamics/adp-model-deployment
Default value can be overridden.

MlflowServiceDockerImage
Enter your path of image. Repository should be created before starting this cases
griddynamics/adp-mlflow-churn-predictions
Default value can be overridden.

MlflowExperimentDockerImage
Docker image name for MlflowExperiment lambda
griddynamics/mlflowexperiment
Default value can be overridden.

CleanupEpLambdaDockerImage
Docker image name for Cleanup Sagemaker Endpoint Lambda
griddynamics/cleanup-ep-lambda
Default value can be overridden.



Visual Attributes configuration

PytorchModelsBucket

Path to Visual Attributes PyTorch Models bucket

adp-rnd-ml-models/visual-attribution/pytorch-models-casted

Default value can be overridden.

GitHubRepositoryVA

[OPTIONAL] The Git repository associated with the notebook instance as its default code repository

VADockerImage

Docker image name for Visual Attributes service

griddynamics/adp-visual-attributes

Default value can be overridden.

VAInitLambdaDockerImage

Docker image name for Visual Attributes lambda

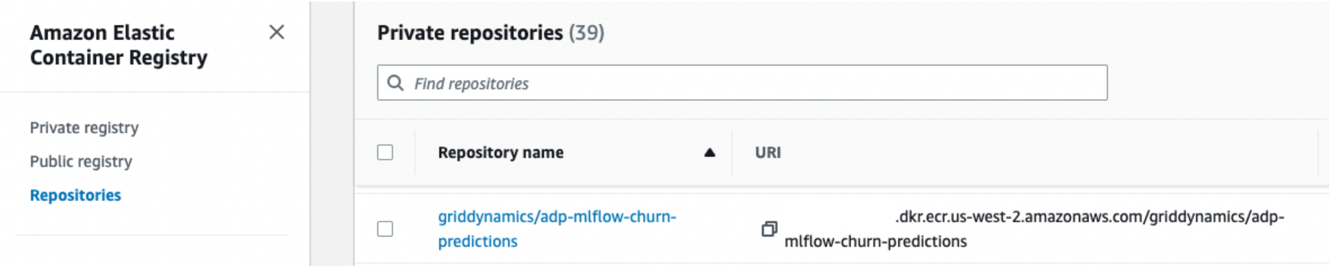
griddynamics/vainit-lambda

Default value can be overridden.

The visual attributes configuration process is the same as the promotion planning use case discussed above.

Important!

1. Before you proceed with cloudformation template installation, pull the images (**MlflowExperimentDockerImage**, **CleanupEpLambdaDockerImage**, **VAinitLambdaDockerImage**) from Marketplace, create ECR in your AWS account and push it there. Change the path to yours ECR in **MlflowExperimentDockerImage**, **CleanupEpLambdaDockerImage**, **VAinitLambdaDockerImage** when launch/update use cases
2. Before running this case **MlflowServiceImageRepository** should be created at AWS Account on Elastic Container Registry Resource. It's can be looks like this:



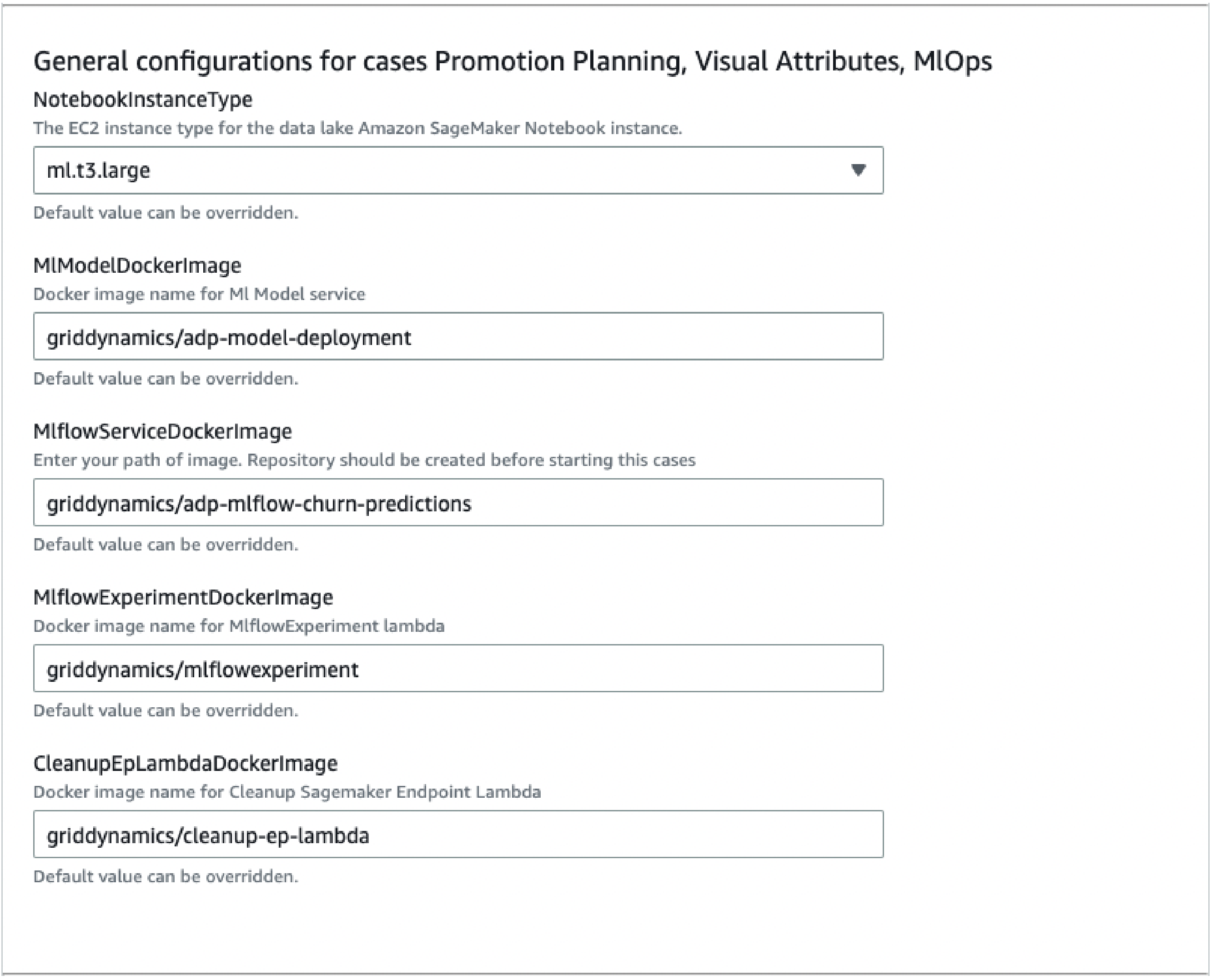
Private repositories (39)

	Repository name ▲	URI
□	griddynamics/adp-mlflow-churn-predictions	.dkr.ecr.us-west-2.amazonaws.com/griddynamics/adp-mlflow-churn-predictions

MLOps

ML platform is infrastructure-as-a-code solution which provides tooling and automation to develop, test, pass though CI pipeline, create artifacts and release as REST endpoint. Platform support two ways of serving: through standard SageMaker REST endpoints or running on top of Kubernetes.

MLOps provisions Sagemaker, creates notebook instances, and loads an already prepared Jupyter notebook. Data required for the model is available at S3 bucket adp-rnd-ml-datasets prepared by our team. The model will be stored in a private bucket that is provisioned by CloudFormation automation. Once a model is created, it also spins up a web UI to demonstrate the recommendation in action. Capability provisioning is straightforward:



General configurations for cases Promotion Planning, Visual Attributes, MlOps

NotebookInstanceType

The EC2 instance type for the data lake Amazon SageMaker Notebook instance.

ml.t3.large ▼

Default value can be overridden.

MlModelDockerImage

Docker image name for Ml Model service

griddynamics/adp-model-deployment

Default value can be overridden.

MlflowServiceDockerImage

Enter your path of image. Repository should be created before starting this cases

griddynamics/adp-mlflow-churn-predictions

Default value can be overridden.

MlflowExperimentDockerImage

Docker image name for MlflowExperiment lambda

griddynamics/mlflowexperiment

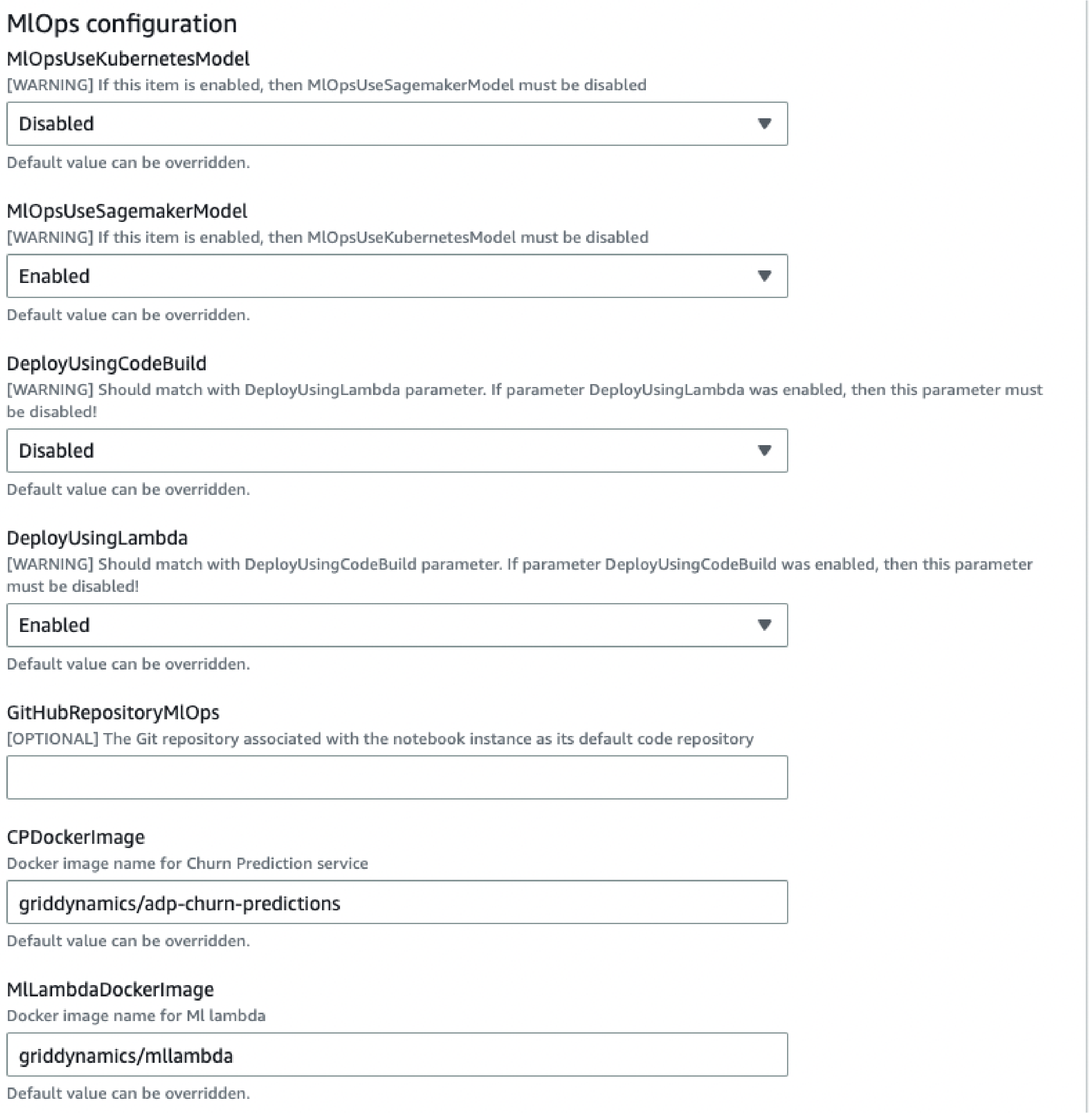
Default value can be overridden.

CleanupEpLambdaDockerImage

Docker image name for Cleanup Sagemaker Endpoint Lambda

griddynamics/cleanup-ep-lambda

Default value can be overridden.



MlOps configuration

MlOpsUseKubernetesModel

[WARNING] If this item is enabled, then MlOpsUseSagemakerModel must be disabled

Disabled ▼

Default value can be overridden.

MlOpsUseSagemakerModel

[WARNING] If this item is enabled, then MlOpsUseKubernetesModel must be disabled

Enabled ▼

Default value can be overridden.

DeployUsingCodeBuild

[WARNING] Should match with DeployUsingLambda parameter. If parameter DeployUsingLambda was enabled, then this parameter must be disabled!

Disabled ▼

Default value can be overridden.

DeployUsingLambda

[WARNING] Should match with DeployUsingCodeBuild parameter. If parameter DeployUsingCodeBuild was enabled, then this parameter must be disabled!

Enabled ▼

Default value can be overridden.

GitHubRepositoryMlOps

[OPTIONAL] The Git repository associated with the notebook instance as its default code repository

CPDockerImage

Docker image name for Churn Prediction service

griddynamics/adp-churn-predictions

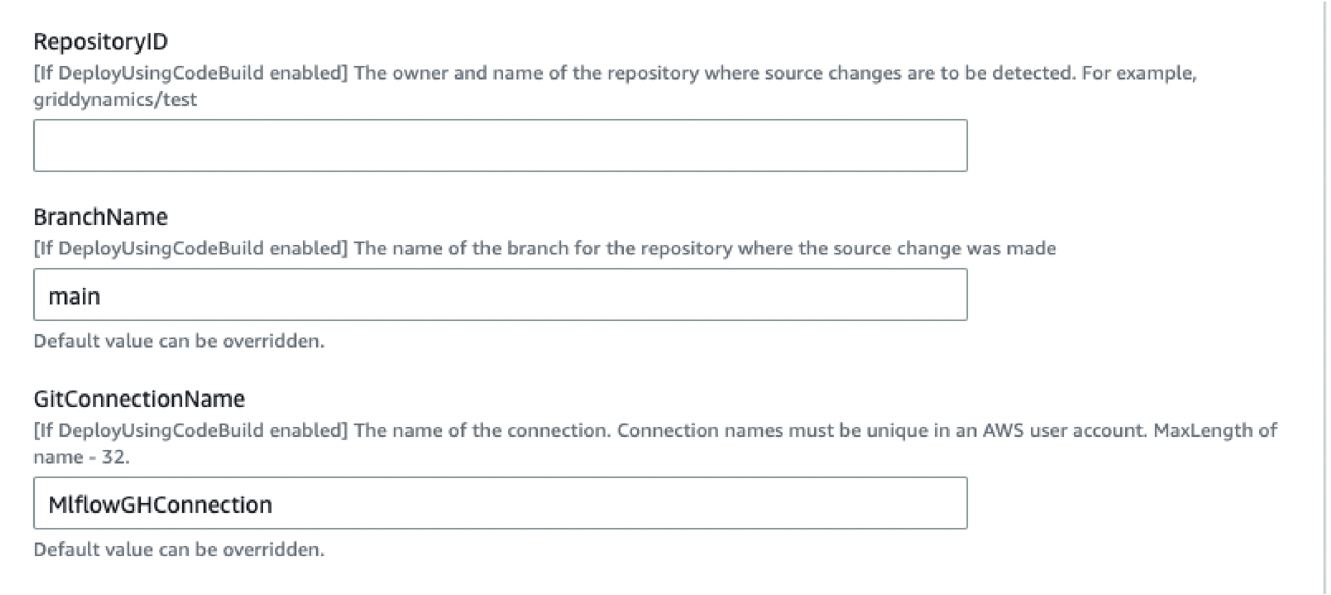
Default value can be overridden.

MlLambdaDockerImage

Docker image name for Ml lambda

griddynamics/mllambda

Default value can be overridden.



RepositoryID

[If DeployUsingCodeBuild enabled] The owner and name of the repository where source changes are to be detected. For example, griddynamics/test

BranchName

[If DeployUsingCodeBuild enabled] The name of the branch for the repository where the source change was made

main

Default value can be overridden.

GitConnectionName

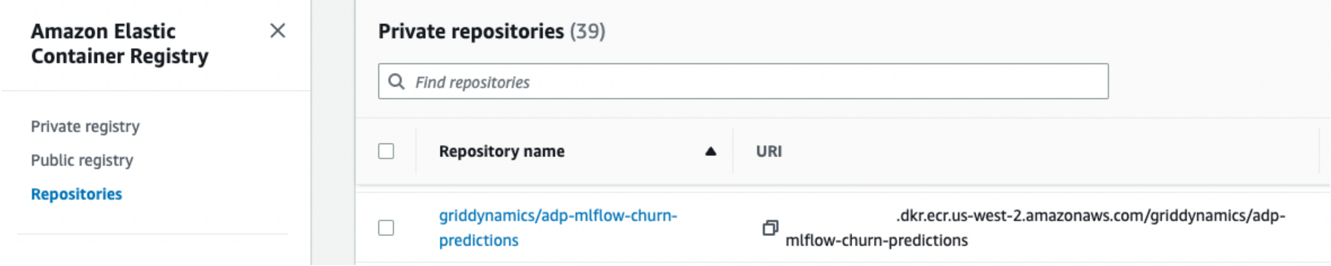
[If DeployUsingCodeBuild enabled] The name of the connection. Connection names must be unique in an AWS user account. MaxLength of name - 32.

MlflowGHConnection

Default value can be overridden.

Important!

1. Before you proceed with cloudformation template installation, pull the images (**MlflowExperimentDockerImage**, **CleanupEpLambdaDockerImage**, **MlLambdaDockerImage**) from Marketplace, create ECR in your AWS account and push it there. Change the path to yours ECR in **MlflowExperimentDockerImage**, **CleanupEpLambdaDockerImage**, **MlLambdaDockerImage** when launch/update use cases
2. Before running this case **MlflowServiceImageRepository** should be created at AWS Account on Elastic Container Registry Resource. It's can be looks like this:



□	Repository name	URI
□	griddynamics/adp-mlflow-churn-predictions	.dkr.ecr.us-west-2.amazonaws.com/griddynamics/adp-mlflow-churn-predictions

Anomaly detection

Anomaly detection capability is fully covered in a separate post.

Conclusion

Analytical Data Platform is a modular platform with six major capabilities. Each of these can be deployed separately or share the same resources like EMR or Redshift. Deployment is based on the CloudFormation stack and is fully automated. It takes less than a day to deploy all capabilities however, for promotion planning and visual attributes it takes a significant amount of time to train and create the models. The platform is fully operable and ready to be integrated with external data sources.