
Cost Optimizer for Amazon WorkSpaces Implementation Guide



Cost Optimizer for Amazon WorkSpaces: Implementation Guide

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Monitor Amazon WorkSpaces usage and optimize costs with the Cost Optimizer for Amazon WorkSpaces solution

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The Cost Optimizer for Amazon WorkSpaces solution analyzes all of your [Amazon WorkSpaces](#) usage data and automatically converts the WorkSpace to the most cost-effective billing option (hourly or monthly), depending on your individual usage. Amazon WorkSpaces is a fully managed, secure Desktop-as-a-Service (DaaS) offering that eliminates the need for you to procure, deploy, and manage complex virtual desktop environments.

This solution helps you monitor your WorkSpaces usage and optimize costs and uses [AWS CloudFormation](#) to automatically provision and configure the necessary Amazon Web Services, Inc. (AWS) services to convert the billing mode for individual WorkSpaces. This solution supports a multi-account environment in AWS Organizations and is capable of running in the AWS GovCloud (US) Regions.

This implementation guide provides architectural considerations and configuration steps for deploying this solution on the AWS Cloud. It includes links to CloudFormation templates that launch, configure, and run the AWS compute, management, storage, and other services required to deploy this solution on AWS, using AWS best practices for security and availability.

The guide is intended for IT infrastructure architects, administrators, and DevOps professionals who have a working knowledge of WorkSpaces and architecting on the AWS Cloud.

Cost

You are responsible for the cost of the AWS services used while running this solution. The total cost of running this solution depends on the number of WorkSpaces that this solution monitors. As of November 2022, the cost for running this solution with default settings in the US East (N. Virginia) Region is approximately **\$0.005 per day** for a deployment with 25 WorkSpaces. This reflects AWS Lambda, Amazon CloudWatch, and AWS Fargate charges and does not include the cost of the individual WorkSpaces (refer to [Amazon WorkSpaces Pricing](#)). You will also incur variable charges from Amazon S3. For a detailed cost breakdown, refer to the following examples.

AWS service	Dimensions	Scenario 1* total cost (per month) [USD]	Scenario 2** total cost (per month) [USD]
Amazon CloudWatch	API calls to get metrics	\$2.00	\$7.00
Amazon ECS	ECS task	\$1.00	\$2.00
Amazon S3	Cost Optimizer Report bucket	\$1.00	\$1.00
Total		\$4.00	\$10.00

<p>*Scenario 1:</p> <ul style="list-style-type: none"> Number of WorkSpaces: 1,000 Number of Amazon Elastic Container Service (Amazon ECS) Task runs per month: 30 Amazon ECS task run time in seconds: 600 	<p>**Scenario 2:</p> <ul style="list-style-type: none"> Number of WorkSpaces: 5,000 Number of Amazon ECS task runs per month: 30 Amazon ECS task run time in seconds: 1,200
---	---

Note

The default values provided in Cost Optimizer for Amazon WorkSpaces for each of the WorkSpaces bundle type should be considered a guidance value only. Review Amazon WorkSpaces pricing for the AWS Region where you deployed the solution to determine the value for your location. Pricing differences between AWS Regions can mean a different billing break-even point between AutoStop and AlwaysOn instances.

Prices are subject to change. For full details, see the pricing webpage for each AWS service you will be using in this solution.

Architecture overview

Deploying this solution builds the following environment in the AWS Cloud.

Note: This solution includes both a **hub account template** (deployed first) for a central account to manage the Workspaces and provide a centralized report, and a **spoke account template** (deployed second) for each Workspace account that you want to monitor. The solution generates a report per directory and also an aggregated report with information about WorkSpaces from all the directories combined.

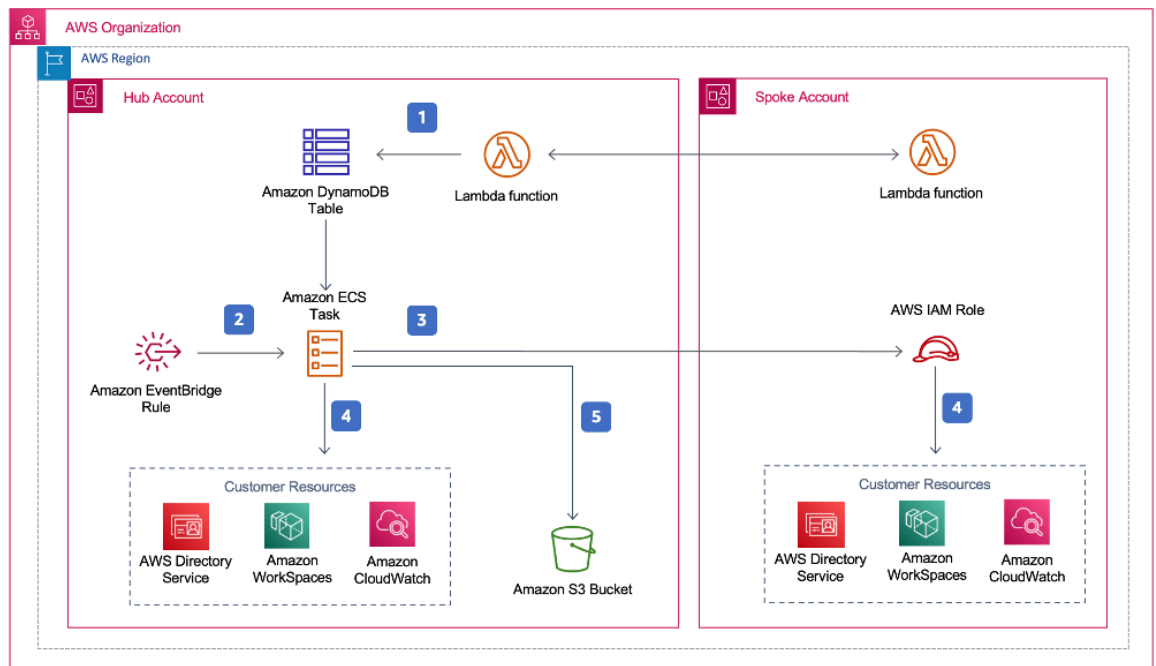


Figure 1: Cost Optimizer for Amazon WorkSpaces architecture

1. The spoke template creates a **custom resource** that invokes an **AWS Lambda** function to register the account as a spoke account in an **Amazon DynamoDB** table in the hub account.
2. The hub template creates an **Amazon EventBridge** rule that invokes an **Amazon Elastic Container Service (Amazon ECS)** task every 24 hours.
3. The Amazon ECS task assumes an **AWS Identity and Access Management (IAM)** role in each spoke account to manage WorkSpaces.
4. The Amazon ECS task polls **AWS Directory Service** to gather a list of all directories registered for Amazon WorkSpaces in a specific AWS Region. The task then checks the total usage for each Workspace that is on an hourly billing model. If a Workspace has met the monthly usage threshold, the solution will convert the individual Workspace to monthly billing.

Note

If a Workspace starts in monthly billing or the solution converts a Workspace from hourly to monthly billing, the solution will not convert the Workspace to hourly billing until the beginning of the next month if usage was below the threshold. However, you can manually change the billing model at any time using the Amazon WorkSpaces console. Also, you can change the threshold for when each Workspace converts from hourly to monthly billing. For more information, refer to [Billing Model Conversion](#). (p. 5)

The solution also features a dry run mode (activated by default) that allows you to gain insight into how the recommended changes will affect your costs. For more information, refer to [Dry Run Mode \(p. 5\)](#).

At the end of the month, the Amazon ECS task checks the total usage for each Workspace that is on a monthly billing model. If a Workspace has not met the monthly usage threshold, the solution will convert the individual Workspace from monthly to hourly billing at the start of the next month.

5. The Amazon ECS task uploads the results of each execution to an Amazon S3 bucket.

Note

Check your Amazon S3 bucket frequently to track the optimizer's activity, and to view logs with error messages.

Implementation considerations

Dry run mode

We recommend that you run this solution in the dry run mode (activated by default) for a few months, review the daily and monthly reports, and manually implement any desired changes. Dry run mode provides insight into how the recommended changes may affect your WorkSpaces costs and allows you to evaluate and analyze the solution's recommendations without the solution automatically implementing billing changes. When you are comfortable with the recommendations provided by the solution and would like these recommendations to be automatically implemented, change the template parameter **Dry Run Mode** to No. The solution will then begin to automatically implement future billing changes based on the recommendations provided in its daily and monthly reports.

Billing model conversion

When the **Dry Run Mode** parameter is set to No, the solution converts a WorkSpace to monthly or hourly billing model, depending on the WorkSpace utilization for the given month. If WorkSpace utilization exceeds the usage threshold, the billing model changes to monthly on the day the utilization exceeds the threshold. The conversion from monthly to hourly mode only happens on the last day of the month. If WorkSpace utilization for the entire month was lesser than or equal to usage threshold, the billing model changes to hourly on the last day of the month.

Hourly to monthly

This solution calculates the hourly WorkSpace usage for each WorkSpace once per day, right before midnight GMT. Note that the calculation includes that day's usage. When the **Dry Run Mode** parameter is set to No, the solution automatically converts individual WorkSpaces from an hourly billing model to a monthly billing model if the WorkSpace exceeds an hourly usage threshold for that particular WorkSpace type.

By default, the threshold is set close to the hourly and monthly billing break-even point. However, you can use the solution's hub template parameters to change the threshold for when each WorkSpace converts from hourly to monthly billing.

Note

Because the solution cannot convert WorkSpaces before the calculation at midnight, the default configuration may result in some WorkSpaces exceeding the threshold for up to 24 hours. For example, the default threshold for a Standard instance is set to 85. If, at midnight on Monday, your usage is 84, the WorkSpace will not be converted to monthly billing. If the usage exceeds 85 after midnight on Monday, the WorkSpace will not be converted until the calculation at midnight on Tuesday.

If several of your WorkSpaces consistently exceed the threshold before being converted, consider lowering the threshold. If several of your WorkSpaces are prematurely converted before exceeding the threshold, consider raising the threshold.

To mitigate this potential discrepancy, we recommend carefully monitoring your usage using dry run mode and adjusting the threshold to your needs before setting the **Dry Run Mode** parameter to No.

Once the solution converts a WorkSpace from hourly billing to monthly billing, the solution will not convert the WorkSpace back to hourly billing until the beginning of the next month, if usage was below

the monthly usage threshold. However, you can manually change the billing model at any time using the AWS Management Console.

Monthly to hourly

For customers who want to convert WorkSpaces from monthly billing to hourly billing immediately, the solution's AWS CloudFormation template includes a parameter (**Simulate End of Month**) that will run these conversions at the time of deployment.

Opt out WorkSpaces

To prevent the solution from converting a Workspace between billing models, apply a resource tag to the Workspace using the tag key `Skip_Convert` and any tag value. This solution will log tagged WorkSpaces, but it will not convert the tagged WorkSpaces. Remove the tag at any time to resume automatic conversion for that Workspace.

Opt in Regions

This solution provides the **List of AWS Regions** input parameter, which specifies the AWS Regions monitored by the solution. You can provide a comma-separated list of AWS Regions that you want to monitor. If this input parameter is left blank, the solution will default to monitoring WorkSpaces in all the AWS Regions for the account.

Regional deployment

You must launch the solution in an AWS Region that supports AWS Lambda, Amazon WorkSpaces, and AWS Fargate services. However, once deployed, the solution will monitor the WorkSpaces in any AWS Region. The solution can also monitor the WorkSpaces in the AWS GovCloud (US) Regions. After you deploy the solution in an AWS GovCloud (US) Region, the Amazon ECS task will pull the Docker image hosted in the AWS public Amazon ECR repository and monitor the workspaces in the AWS GovCloud (US) Region.

For the most current availability by Region, refer to the [AWS Regional Services List](#).

AWS Organizations support

The solution supports AWS Organizations through a hub-and-spoke architecture. To monitor Workspaces across multiple accounts in your Organization, enable trusted access for [AWS Resource Access Manager \(AWS RAM\)](#) in the management account of your Organization. For more information on how to enable trusted access for RAM, please refer to [AWS Resource Access Manager and AWS Organizations](#).

You can deploy the hub template in the central account, and then deploy the spoke template in each account that manages WorkSpaces. The spoke stacks must be deployed in the same Region as the hub stack.

For a multi-account deployment, provide the value for **Organization ID for multi account deployment** and **Account ID of the Management Account for the Organization**.

For a single-account deployment, or to manage WorkSpaces only in the central account, deploy only the hub and leave the value for the input parameter **Organization ID for multi account deployment** as blank.

Deployment in an existing Amazon VPC

This solution creates a new [Amazon Virtual Private Cloud \(Amazon VPC\)](#) to run the Amazon ECS task. If desired, you can deploy the solution in an existing Amazon VPC by providing the subnet IDs and security group ID as part of the input parameters to the CloudFormation template. To run the solution in an existing Amazon VPC, the Amazon ECS task needs to run in a public subnet, or a private subnet with a route to the Internet. This route is necessary because the Amazon ECS task will pull the Docker image hosted in a public [Amazon Elastic Container Registry \(Amazon ECR\)](#) repository. The security group used to run the ECS task will allow you to pull this image from ECR repository.

Maintenance calculation

If you run your patches or other maintenance scripts by changing the WorkSpaces to ALWAYS_ON mode, you will need to account for the ALWAYS_ON hours and adjust the threshold values in the CloudFormation template accordingly. For example, if you change the mode from AUTO_STOP to ALWAYS_ON for 10 hours to run the maintenance scripts, you should subtract 10 hours from the set threshold value in the CloudFormation template.

Modifying WorkSpace properties

The solution uses the Describe_Workspaces application programming interface (API) call to calculate the idle timeout for a WorkSpace. This value is a point in time and does not provide historical data for the idle time. If you change the idle timeout for a WorkSpace in the middle of a month, the billable hours will use the new idle timeout and apply it for the entire month. For this reason, the billable hours that the solution calculates will not match the billable hours that the WorkSpace service charges. The solution will use the new idle timeout value and calculate correct billable hours from the following month. You can skip the WorkSpace processing for the current month by adding a Skip_Convert tag to the WorkSpace.

Delete unused WorkSpaces

Important

Opting into this feature deletes unused WorkSpaces and can cause changes to your existing CloudFormation stack. Changes to existing CloudFormation resources might cause a drift between the resource state and its definition in the stack. Ensure that these changes do not impact your existing resources and applications before opting into this feature.

The solution allows you delete unused WorkSpaces permanently. The solution provides three options for this feature:

- **Yes** – You can opt into this feature by selecting Yes for the **TerminateUnusedWorkspaces** input parameter. If opted in, the solution will identify all the WorkSpaces not used during the month based on the last known user connection timestamp. The solution will only delete the WorkSpace if:
 - The WorkSpace is available on the first day of the month
 - The **Launch in Dry Run Mode** input parameter is set to No

- The billable hours for the WorkSpace is zero
- There are no Skip_Convert tag keys on the WorkSpaces
- **Dry Run** – When you select **Dry Run** for the **TerminateUnusedWorkspaces** input parameter, the solution checks for all the conditions for a WorkSpace to be deleted and update the report, but will not execute the deletion.

Note

We recommend running this feature in Dry Run mode for the first few months and checking the monthly reports to review which WorkSpaces are marked for deletion.

- **No** – By default, the option is turned off (set to No).

This check for deleting unused WorkSpaces will run only on the last day of the month. If the solution deletes a WorkSpace because it met all the above criteria, the monthly report will show **Yes** as the value in the **Workspace Terminated** column. In Dry Run mode, the monthly report will show **Yes-Dry Run** for the WorkSpace that met all the criteria mentioned above.

CUDOS Dashboard

While this solution helps you optimize WorkSpaces costs, to see the actual cost savings, you can also deploy a CUDOS dashboard by following the steps in our [CUDOS Dashboard lab](#) and see the metrics for the cost saving. After deploying the CUDOS dashboard, you can navigate to the **End User Computing** tab to see the graphs for **Average Workspaces Cost per region** and **Workspaces spend per region**.

Security

When you build systems on AWS infrastructure, security responsibilities are shared between you and AWS. This [shared model](#) can reduce your operational burden as AWS operates, manages, and controls the components from the host operating system and virtualization layer down to the physical security of the facilities in which the services operate. For more information about security on AWS, visit the [AWS Security Center](#).

IAM roles

This solution creates IAM roles to control and isolate permissions, following the best practice of least privilege. The solution grants services the following permissions:

Hub template

`RegisterSpokeAccountsFunctionLambdaRole`

- Write permission to Amazon DynamoDB table where spoke accounts are registered

`InvokeECSTaskRole`

- Permission to create and run Amazon ECS tasks

`CostOptimizerAdminRole`

- Read permissions to an Amazon DynamoDB table where spoke accounts are registered
- Assume role permissions to `WorkspacesManagementRole` in spoke accounts
- Read only permissions to AWS Directory Service
- Write permissions to Amazon CloudWatch Logs
- Write permissions to Amazon S3
- Read/write permissions to WorkSpaces

`SolutionHelperRole`

- Permission to invoke an AWS Lambda function to generate a universally unique identifier (UUID) for solution metrics

Spoke template

`WorkSpacesManagementRole`

- Read only permissions to AWS Directory Service
- Write permissions to Amazon CloudWatch Logs
- Write permissions to Amazon S3
- Read/write permissions to WorkSpaces

AccountRegistrationProviderRole

- Invoke Lambda function to register spoke account with hub account stack

AWS CloudFormation templates

This solution uses AWS CloudFormation to automate the deployment of Cost Optimizer for Amazon WorkSpaces on the AWS Cloud. It includes the following AWS CloudFormation templates, which you can download before deployment.

Hub account

[View template](#)

workspaces-cost-optimizer.template – Use this template to launch Cost Optimizer for Amazon WorkSpaces and all associated components for your hub account (or single account if you only have one account). The default configuration deploys AWS Lambda functions, an Amazon ECS task definition, an Amazon CloudWatch event, and an Amazon S3 bucket. You can customize the template based on your specific needs.

Spoke accounts

[View template](#)

workspaces-cost-optimizer.spoke.template – Use this template to launch Cost Optimizer for Amazon WorkSpaces and all associated components for your spoke accounts. Do not deploy this template if you only have one account. The default configuration deploys AWS Lambda functions, an Amazon ECS task definition, an Amazon CloudWatch event, and an Amazon S3 bucket. You can customize the template based on your specific needs.

Automated Deployment

Before you launch the automated deployment, please review the architecture, configuration, and other considerations discussed in this guide. Follow the step-by-step instructions in this section to configure and deploy Cost Optimizer for Amazon WorkSpaces into your account.

Important

Deploy the hub template first. If you have a single-account environment, you do not need to deploy the spoke template. If you have a multi-account environment, install the spoke template for each WorkSpaces account you wish to monitor.

Time to deploy: Approximately five minutes

Launch the stack – Hub template

Important

This solution includes an option to send anonymous operational metrics to AWS. We use this data to better understand how customers use this solution and related services and products. AWS owns the data gathered through this survey. Data collection is subject to the [AWS Privacy Policy](#).

To opt out of this feature, download the template, modify the AWS CloudFormation mapping section, and then use the AWS CloudFormation console to upload your template and deploy the solution. For more information, refer to the Collection of Operational Metrics section of this guide.

This automated AWS CloudFormation template deploys Cost Optimizer for Amazon WorkSpaces on the AWS Cloud.

Note

You are responsible for the cost of the AWS services used while running this solution. For more details, see the [Cost \(p. 2\)](#) section of this guide and the pricing webpage for each AWS service that you will be using in this solution.

1. Sign in to the AWS Management Console and choose the following **Launch Solution** button to launch the *workspaces-cost-optimizer* AWS CloudFormation template.



You can also [download the template](#) as a starting point for your own implementation.

2. The template launches in the US East (N. Virginia) Region by default. To launch Cost Optimizer for Amazon WorkSpaces in a different AWS Region, use the Region selector in the console navigation bar.

Important

This solution uses AWS Lambda, AWS Fargate, and Amazon WorkSpaces, which are currently available in specific AWS Regions only. However, once deployed, the solution will monitor the WorkSpaces in any AWS Region. Also, you must launch this solution in the same account as the WorkSpaces you want to monitor. For the most current availability by Region, refer to the [AWS Regional Services List](#).

3. On the **Select Template** page, verify that you selected the correct template and choose **Next**.
4. Under **Parameters**, review the parameters for the template and modify them as necessary. This solution uses the following default values.

Parameter	Default	Description
Launch in Dry Run Mode?	Yes	Generates a change log, but does not execute any changes. For more information, refer to Dry Run Mode (p. 5) .
Simulate End of Month	No	Overrides date and forces the solution to run as if it is the end of the month.
Log Level	INFO	Sets the log level for the Lambda function logs in CloudWatch.
Value Limit	81	The number of hours a Value instance can run in a month before being converted to ALWAYS_ON.
Standard Limit	85	The number of hours a Standard instance can run in a month before being converted to ALWAYS_ON.
Performance Limit	83	The number of hours a Performance instance can run in a month before being converted to ALWAYS_ON.
Power Limit	83	The number of hours a Power instance can run in a month before being converted to ALWAYS_ON.
Graphics Limit	217	The number of hours a Graphics instance can run in a month before being converted to ALWAYS_ON.
PowerPro Limit	80	The number of hours a PowerPro instance can run in a month before being converted to ALWAYS_ON.
GraphicsPro Limit	80	The number of hours a GraphicsPro instance can run in a month before being converted to ALWAYS_ON.
VPC CIDR	10.215.0.0/16	The default VPC CIDR used to deploy the AWS Fargate container dynamically when the solution runs.

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Launch the stack – Hub template

Parameter	Default	Description
Subnet1 CIDR	10.215.10.0/24	One of two subnets in different Availability Zones where the AWS Fargate container is deployed.
Subnet2 CIDR	10.215.20.0/24	The second of two subnets in different Availability Zones where the AWS Fargate container is deployed.
Create New VPC	Yes	Select Yes to deploy the solution in a new Amazon VPC.
Subnet ID for first subnet	<Optional input>	Subnet ID to launch an Amazon ECS task. Leave this blank if you selected Yes for Create New VPC or enter an existing subnet ID to run an Amazon ECS task.
Subnet ID for second subnet	<Optional input>	Subnet ID to launch an Amazon ECS task. Leave this blank if you selected Yes for Create New VPC or enter an existing subnet ID to run an Amazon ECS task.
Security group ID to launch ECS task	<Optional input>	Security group ID to launch an Amazon ECS task Leave this blank if you selected Yes for Create New VPC or enter an existing security group ID to run an Amazon ECS task.
Terminate Unused Workspaces	No	Select Yes to delete WorkSpaces not used for one month.
List of AWS Regions	<i><Requires input></i>	Comma separated list of AWS Regions for the solution to monitor. Example: us-east-1, us-west-2.
Organization ID for multi account deployment	<Optional input>	AWS Organizations ID to support multi-account deployment. Leave blank for single account deployments.

Parameter	Default	Description
Account ID of the Management Account for the Organization	<Optional input>	Account ID for the Organization's management account. Leave blank for single account deployments.

5. Choose **Next**.
6. On the **Options** page, choose **Next**.
7. On the **Review** page, review and confirm the settings. Check the box acknowledging that the template will create IAM resources.
8. Choose **Create** to deploy the stack.

You can view the status of the stack in the AWS CloudFormation console in the **Status** column. You should see a status of CREATE_COMPLETE in approximately five minutes.

Note

In addition to the CostOptimizerCreateTask AWS Lambda function, this solution includes the solution-helper Lambda function, which runs only during initial configuration or when resources are updated or deleted.

When running this solution, you will see all Lambda functions in the AWS Management Console, but only the CostOptimizerCreateTask function is regularly active. However, do not delete the solution-helper function as it is necessary to manage associated resources.

Launch the stack – Spoke template

Important

This solution includes an option to send anonymous operational metrics to AWS. We use this data to better understand how customers use this solution and related services and products. AWS owns the data gathered through this survey. Data collection is subject to the [AWS Privacy Policy](#).

To opt out of this feature, download the template, modify the AWS CloudFormation mapping section, and then use the AWS CloudFormation console to upload your template and deploy the solution. For more information, refer to the Collection of Operational Metrics section of this guide.

This automated AWS CloudFormation template deploys the spoke for Cost Optimizer for Amazon WorkSpaces on the AWS Cloud.

Note

You are responsible for the cost of the AWS services used while running this solution. See the [Cost \(p. 2\)](#) section for more details. For full details, see the pricing webpage for each AWS service you will be using in this solution.

1. Sign in to the AWS Management Console and choose the following **Launch Solution** button to launch the *workspaces-cost-optimizer-spoke* AWS CloudFormation template.



You can also [download the template](#) as a starting point for your own implementation.

2. The template launches in the US East (N. Virginia) Region by default. To launch Cost Optimizer for Amazon WorkSpaces in a different AWS Region, use the Region selector in the console navigation bar.

Important

This solution uses AWS Lambda, AWS Fargate, and Amazon WorkSpaces, which are currently available in specific AWS Regions only. However, once deployed, the solution will monitor the Workspaces in any AWS Region. Also, you must launch this solution in the same account as the WorkSpaces that you want to monitor. For the most current availability by Region, refer to the [AWS Regional Services List](#).

3. On the **Select Template** page, verify that you selected the correct template and choose **Next**.
4. Under **Parameters**, review the parameters for the template and modify them as necessary. This solution uses the following default values:

Parameter	Default	Description
Hub account ID	<i><Requires input></i>	The ID of the hub account for the solution. This stack should be deployed in the same Region as the hub stack in the hub account.
Logging level	INFO	Logging level.

Monitoring this solution with Service Catalog AppRegistry

The Cost Optimizer for Amazon WorkSpaces solution includes a Service Catalog AppRegistry resource to register the CloudFormation template and underlying resources as an application in both AWS Service Catalog AppRegistry and AWS Systems Manager Application Manager.

AWS Systems Manager Application Manager gives you an application-level view into this solution and its resources so that you can:

- Monitor its resources, costs for the deployed resources across stacks and AWS accounts, and logs associated with this solution from a central location.
- View operations data for the resources of this solution in the context of an application, such as deployment status, CloudWatch alarms, resource configurations, and operational issues.

The following figure depicts an example of the application view for the Cost Optimizer for Amazon WorkSpaces stack in Application Manager.

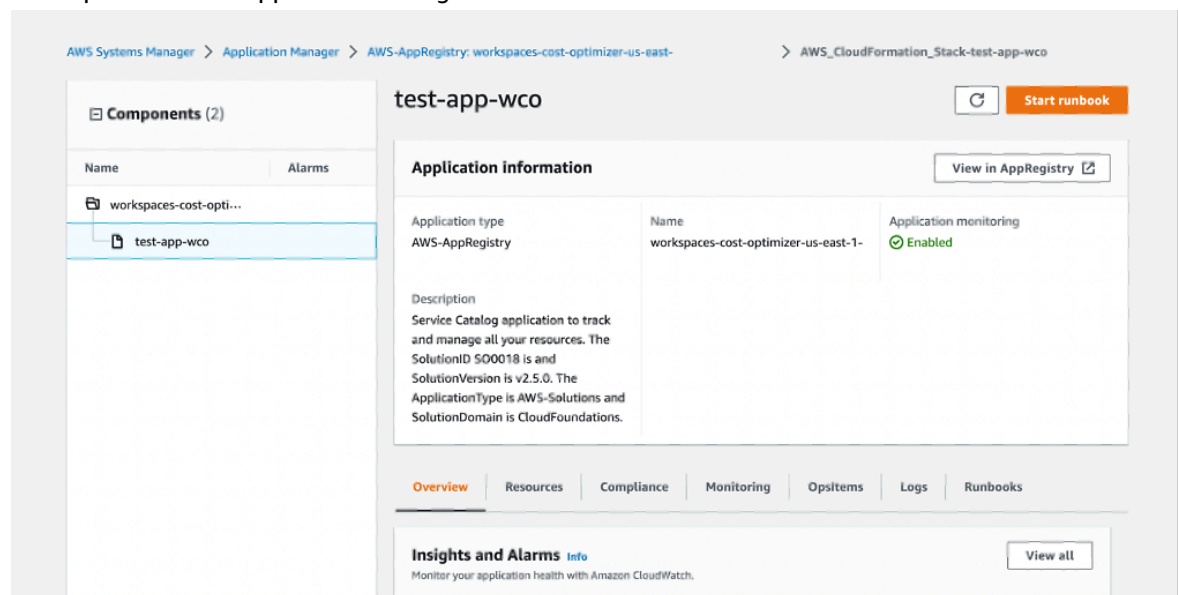


Figure 2: Cost Optimizer for Amazon WorkSpaces stack in Application Manager

Note

The solution activates CloudWatch Application Insights and alarms in Application Manager by default.

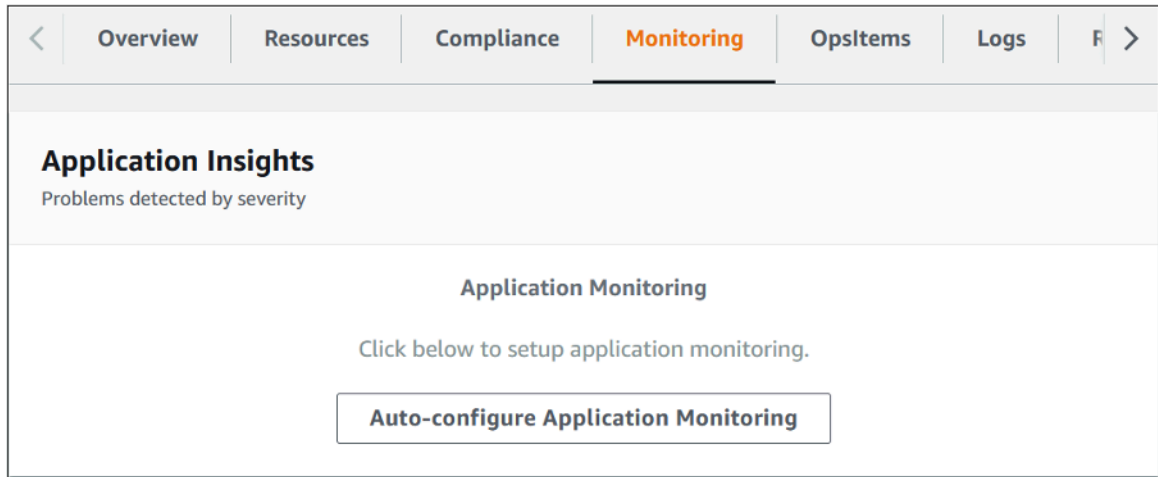
AWS Cost Explorer must be activated. It is not activated by default.

Activate CloudWatch Application Insights

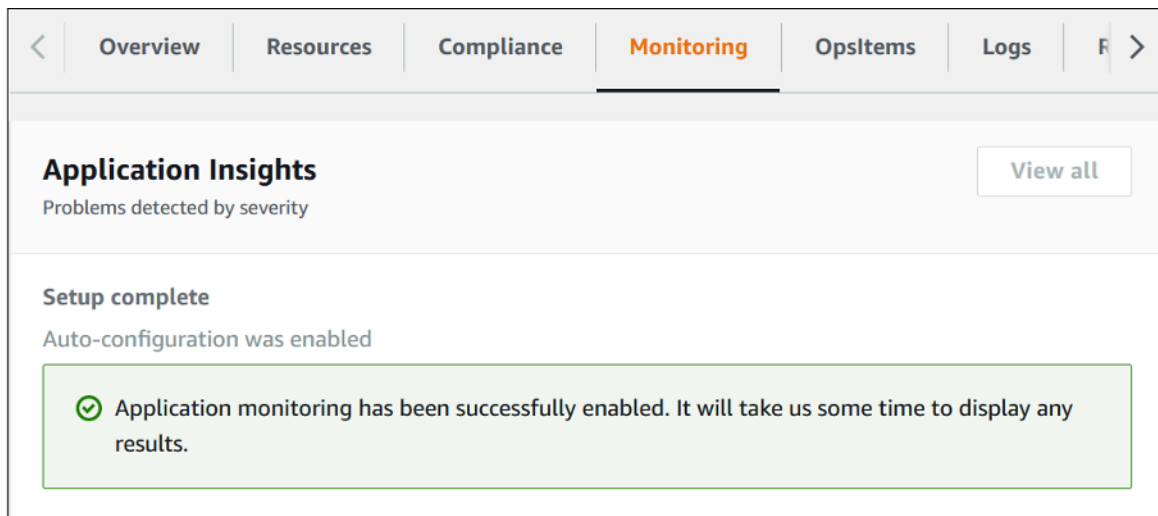
1. Open the [Systems Manager console](#). In the navigation pane, choose **Application Manager**.
2. In **Applications**, choose **AppRegistry applications**.
3. In **AppRegistry applications**, search for the application name for this solution and select it.

The next time you open Application Manager, you can find the new application for your solution in the **AppRegistry application** category.

4. In the **Components** tree, choose the application stack you want to activate.
5. In the **Monitoring** tab, in **Application Insights**, select **Auto-configure Application Monitoring**.



6. Monitoring for your applications is now activated and the following status box appears:



Activate AWS Cost Explorer

You can see the overview of the costs associated with the application and application components within the Application Manager console through integration with AWS Cost Explorer which must be first activated. Cost Explorer helps you manage costs by providing a view of your AWS resource costs and usage over time. To activate Cost Explorer for the solution:

1. Sign in to the [AWS Cost Management console](#).
2. In the left navigation menu, select **Cost Explorer**.

3. On the **Welcome to Cost Explorer** page, choose **Launch Cost Explorer**.

The activation process can take up to 24 hours to complete. Once activated, you can open the Cost Explorer user interface to further analyze cost data for the solution.

Activate cost allocation tags associated with the solution

After you activate Cost Explorer, you must activate a cost allocation tag to see the costs for this solution. The cost allocation tags can only be activated from the management account for the organization. To activate cost allocation tags:

1. Sign in to the [AWS Billing and Cost Management console](#), and select **Cost Allocation Tags** in the left navigation menu.
2. On the Cost allocation tags page, filter for the AppManager:CFNStackKey tag, then select the tag from the results shown.
3. Choose **Activate**

The activation process can take up to 24 hours to complete and the tag data to appear.

Additional Resources

The following links provide additional information about the services used in this solution:

- | | |
|---|--|
| <ul style="list-style-type: none">• AWS CloudFormation• Amazon CloudWatch• AWS Directory Service• Amazon Elastic Container Service• AWS Fargate | <ul style="list-style-type: none">• AWS Lambda• AWS Organizations• Amazon Simple Storage Service• Amazon WorkSpaces |
|---|--|

Update the stack

If you have previously deployed an older version of this solution, follow this procedure to update the Cost Optimizer for WorkSpaces on AWS CloudFormation stack to get the latest version of the solution's framework.

1. Sign in to the [AWS CloudFormation console](#), select your existing `workspaces-cost-optimizer` CloudFormation stack, and select **Update**.
2. Select **Replace current template**.
3. Under **Specify template**:
 - a. Select **Amazon S3 URL**.
 - b. Copy the link of the [latest template](#).
 - c. Paste the link in the **Amazon S3 URL** box.
 - d. Verify that the correct template URL shows in the **Amazon S3 URL** text box, and choose **Next**. Choose **Next** again.
4. Under **Parameters**, review the parameters for the template and modify them as necessary. Refer to [Step 1. Launch the Stack \(p. 12\)](#) for details about the parameters.
5. Choose **Next**.
6. On the **Configure stack options** page, choose **Next**.
7. On the **Review** page, review and confirm the settings. Check the box acknowledging that the template might create IAM resources.
8. Choose **View change set** and verify the changes.
9. Choose **Update stack** to deploy the stack.

You can view the status of the stack in the AWS CloudFormation console in the **Status** column. You should receive a status of `UPDATE_COMPLETE` in approximately 15 minutes.

Troubleshooting

Failed WorkSpaces

The solution will attempt to modify WorkSpace mode based on the threshold hours. When the solution cannot change the WorkSpace mode due to an exception, such as the workspace being in **UNHEALTHY** state or booting up during the conversion, the solution will skip this WorkSpace and continue to process other workspaces in the account. The skipped workspaces will be added to the daily report with the message `Failed to change mode`. You can find more details about the exception in the Amazon ECS logs. The solution will attempt to change the mode again during the next run of the Amazon ECS task.

Redeploying after deletion

If you delete the hub stack and wish to redeploy it, you must also redeploy all of the spoke stacks; redeploying the hub stack will not automatically work with the existing old spoke templates.

Uninstall the solution

You can uninstall Cost Optimizer for Amazon WorkSpaces from the AWS Management Console or by using the AWS Command Line Interface (AWS CLI). Delete all the spoke account stacks and then delete the hub account stack.

Using the AWS Management Console

1. Sign in to the [AWS CloudFormation console](#) for spoke accounts.
2. Select this solution's spoke account main stack.
3. Choose **Delete**.
4. Sign in to the CloudFormation console for the hub account.
5. Select this solution's hub account stack.
6. Choose **Delete**.

Using AWS Command Line Interface

Determine whether the (AWS CLI) is available in your environment. For installation instructions, refer to [What Is the AWS Command Line Interface](#) in the *AWS CLI User Guide*. After confirming that the AWS CLI is available, run the following command.

```
$ aws cloudformation delete-stack --stack-name <installation-stack-name>
```

Collection of operational metrics

This solution includes an option to send anonymous operational metrics to AWS. We use this data to better understand how customers use this solution and related services and products. When invoked, the following information is collected and sent to AWS:

- **Solution ID** - The AWS solution identifier.
- **Unique ID (UUID)** - Randomly generated, unique identifier for each Cost Optimizer for Amazon WorkSpaces on AWS deployment.
- **Timestamp** - Data-collection timestamp.
- **WorkSpaces Data** - The number and billing model of WorkSpaces that the Cost Optimizer for Amazon WorkSpaces on AWS manages in each AWS Region

Example data:

```
{
  noChange: 103
  error: 0
  toHourly: 0
  toMonthly: 17
}
```

AWS owns the data gathered through this survey. Data collection is subject to the [AWS Privacy Policy](#). To opt out of this feature, complete the following steps before launching the CloudFormation template.

1. Download the CloudFormation template to your local hard drive.
2. Open the CloudFormation template with a text editor.
3. Modify the CloudFormation template mapping section from:

```
Mappings:
  Solution:
    Data:
      SendAnonymousUsageData: True
```

to

```
Mappings:
  Solution:
    Data:
      SendAnonymousUsageData: False
```

4. Sign in to the [AWS CloudFormation console](#).
5. Select **Create stack**.
6. On the **Create stack** page, **Specify template** section, select **Upload a template file**.
7. Under **Upload a template file**, choose **Choose file** and select the edited template from your local drive.
8. Choose **Next** and follow the steps in the [Automated deployment \(p. 12\)](#) section of this guide.

Source Code

Visit our [GitHub repository](#) to download the templates and scripts for this solution, and to share your customizations with others. Refer to the [README.md](#) file for additional information.

Contributors

The following individuals contributed to this document:

- Chaitanya Deolankar
- Max Granat
- Matt Juairé
- Michael Ortwein
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Document Revisions

Date	Change
January 2017	Initial release
March 2017	Added a function to the child AWS Lambda function and updated the parameters
February 2018	Added a Power instance parameter and updated the anonymous data collection configuration
May 2018	Updated for clarity on the Dry Run Mode provided by the solution
December 2018	Added clarification on billing conversion
February 2019	Converted parent and child AWS Lambda functions to AWS Fargate container solution
December 2019	Added information on support for Node.js update
April 2020	Bug fixes
June 2021	Release version 2.3.0: Bug fixes and support for existing VPCs. For more information, refer to the CHANGELOG.md file in the GitHub repository
September 2021	Release version 2.4.0: Added support for opt-in Regions and deleting unused WorkSpaces. For more information, refer to the CHANGELOG.md file in the GitHub repository
October 2021	Release version 2.4.1: Bug fixes. For more information, refer to the CHANGELOG.md file in the GitHub repository
August 2022	Release version 2.5.0: Added AWS Organizations support. For more information, refer to the CHANGELOG.md file in the GitHub repository
November 2022	AppRegistry: AppRegistry Application Stack Association and Application Insights. For more information, refer to the CHANGELOG.md file in the GitHub repository.

Notices

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AWS glossary

For the latest AWS terminology, see the [AWS glossary](#) in the *AWS General Reference*.