



Cost Management and Best Practices

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Welcome to Cost Management and Best Practices.

What you will learn

At the core of the lesson

You will learn how to:

- Describe some of the cost benefits of the cloud.
- Identify key AWS cost management tools and services.
- Apply best practices for cost optimization.



In this module, you will learn strategies, tools and best practices for reducing cost in the AWS Cloud.

Specifically, you will learn how to:

- Describe some of the cost benefits of the cloud.
- Identify key AWS cost management tools and services.
- Apply best practices for cost optimization.

Cost benefits of the cloud and opportunities for cost reduction

Cost benefits of the AWS Cloud:

- Pay only for what you need, when you need it.
- Create scripts or templates to shut down environments.
- Can turn off unused resources
 - Specific services after business hours and during holidays
 - Development or test environments
 - Disaster recovery (DR) environments
 - Instances that are tagged as temporary



AWS Cloud

One of the fundamental benefits of cloud computing is that you pay only for what you need, when you need it. Because of this principle, you can seek ways to use your cloud resources efficiently and reduce cost. You can use various strategies to achieve this goal, including:

- Creating scripts or templates that can easily start up and shut down entire environments.
- Turning off unused resources. For example –
 - Development or test environments can be shut down at project termination.
 - Specific services can be shut down after business hours and during holidays.
 - Disaster recovery (DR) environments can remain inactive until you need them.
 - Temporary instances that are tagged as such can be turned off after a specified time period.

AWS cost management tools and services



AWS Cost and Usage Report

AWS billing dashboard

- View the overall status of your costs and usage.
- Access your monthly bill.



AWS Cost Explorer

AWS Cost Explorer

- Visualize, understand, and manage your AWS costs and usage over time.
- Forecast future costs and usage.



AWS Budgets

AWS Budgets

- Set custom cost and usage budgets.
- Receive alerts you when your costs or usage exceed these thresholds.



Amazon CloudWatch

Amazon CloudWatch

- Monitor your usage charges.
- Receive an alert when they reach a specified threshold.

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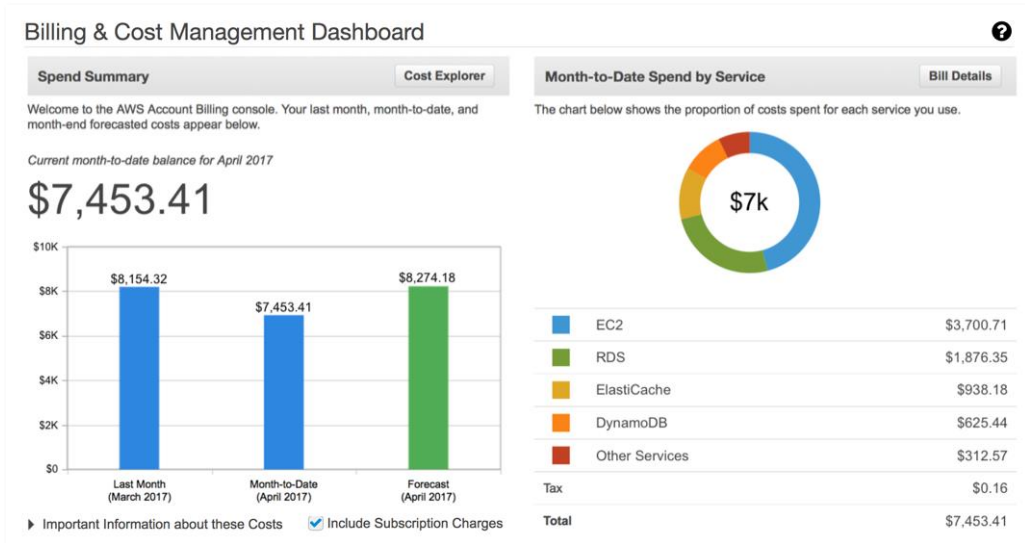
You can also use AWS cost management tools and services to help you access, organize, understand, control, and optimize your AWS costs and usage. For example:

- You can access the overall status of your AWS costs and usage in the *AWS billing dashboard*. The dashboard provides a *Bills* page that shows you the most up-to-date information about your costs and usage. This information includes your monthly bill and a detailed breakdown of the AWS services that you use. You can also use the *AWS Cost and Usage Reports* page to generate a report that shows the most granular data about your AWS costs and usage. This report enables you to better analyze and understand your AWS costs, and the specific product offerings and usage amounts that underlie those costs.
- You can dive deeper into your cost and usage data with *AWS Cost Explorer* to identify trends, pinpoint cost drivers, and detect anomalies. This service provides an intuitive interface that enables you to quickly create custom reports (including charts and tabular data). You can use these reports to analyze your cost and usage data, both at a high level and for specific requests.
- You can set custom cost targets and usage budgets with *AWS Budgets*. This service then alerts you when those thresholds are exceeded.
- You can monitor your usage charges by using Amazon CloudWatch. You create

alarms to notify you when your usage charges exceed a threshold that you specify.

You will learn about these tools and services in more detail in the next slides.

AWS billing dashboard



The AWS billing dashboard enables you to view the status of your month-to-date AWS expenditure. You can also use it to identify the services that account for the majority of your overall expenditure. You can also use the AWS billing dashboard to get a high-level understanding of how your costs are trending.

One of the graphs in the dashboard is the *Spend Summary*. It shows you how much you spent last month, the cost of your AWS usage month-to-date, and a forecast of how much you are likely to spend this month. Another graph is the *Month-to-Date Spend by Service* graph. It shows the top services that you use the most, and the proportion of your costs that are attributed to that service.

You can access several other cost management tools from the billing dashboard. You can use these tools to estimate and plan your AWS costs, including AWS Bills, AWS Cost Explorer, AWS Budgets and AWS Cost and Usage Reports.

AWS Bills

AWS Bills lists the costs that you incurred over the past month

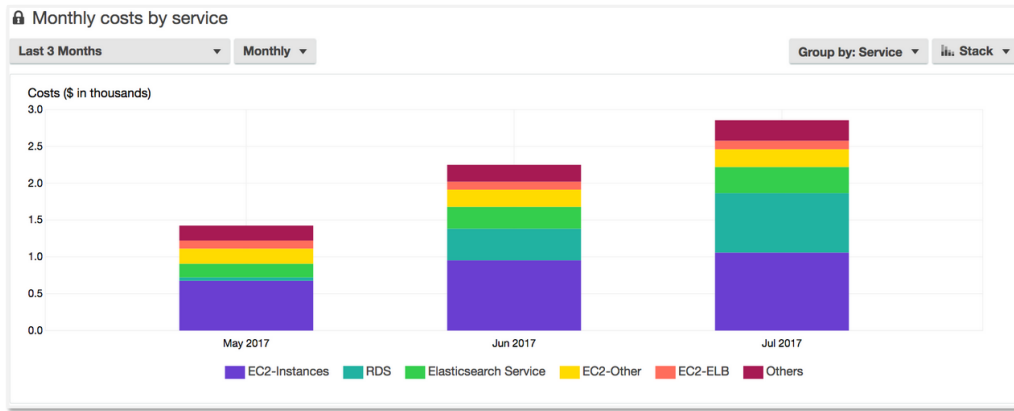
BILLS COST EXPLORER BUDGETS REPORTS		
Total		\$7,453.41 USD
AWS Marketplace Charges		\$15.00
▼ Usage Charges and Recurring Fees		\$15.00
Invoice 32342548 – AWS Service Charges: Usage charge for this statement period	2017-10-10	\$15.00
AWS Service Charges		\$7,438.41
▼ Usage Charges and Recurring Fees		\$7,414.41
Invoice 32342513 – AWS Service Charges: Usage charge for this statement period	2017-10-10	\$7,414.41
▼ Usage Charges and Recurring Fees		\$24.00
Invoice 32342507 – AWS Service Charges: Subscription charge	2017-10-10	\$24.00

The *AWS Bills* page lists the costs that you incurred over the past month for each AWS service. It also includes a further breakdown by AWS Region and linked account.

This tool gives you access to the most up-to-date information about your costs and usage, including your monthly bill and the detailed breakdown of the AWS services that you use.

AWS Cost Explorer

Can export cost data to a .csv file



To learn more, refer to: [Consolidated billing for AWS Organizations](#)



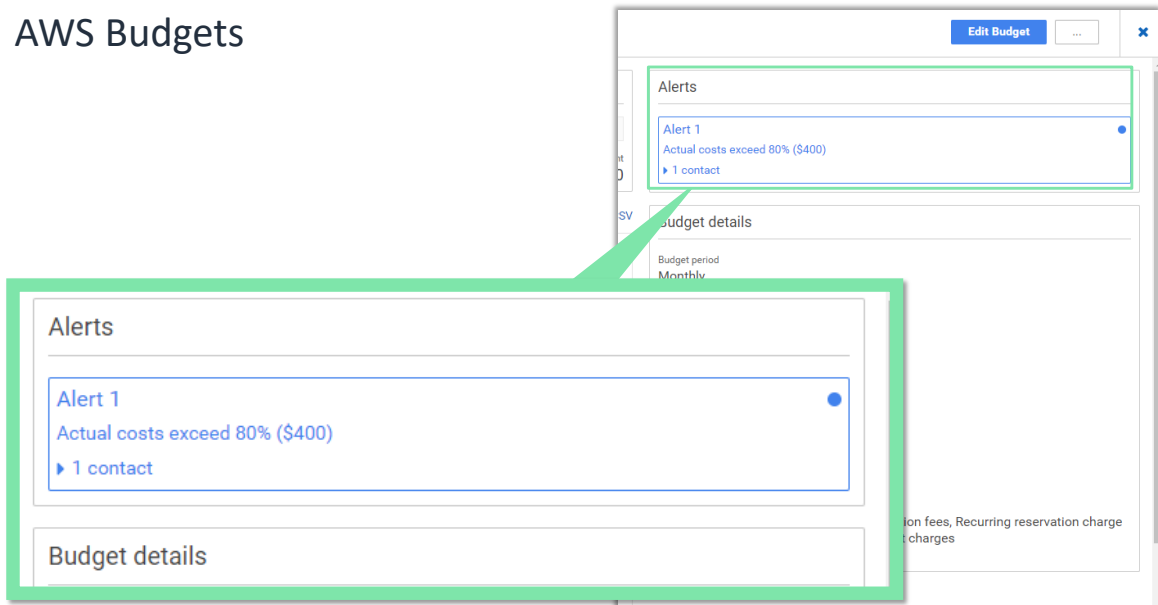
AWS Cost Explorer enables you to view your costs and usage, and to analyze them to identify trends. You can filter and group data along various dimensions, such as service, instance type, and tag. Cost Explorer provides you with two types of default reports:

- **Cost and Usage** reports – These reports enable you to understand your costs and usage for all services. For example, the *Monthly costs by service* report (displayed in the screen capture) shows your costs for the last 3 months, grouped by service. The top five services are shown by themselves, and the rest are grouped into one bar (labeled *Others*).
- **Reserved Instance (RI)** reports – These reports are specific to your Reserved Instances usage. They provide an understanding of your comparative utilization costs for Reserved Instances versus On-Demand Instances.

You can view data for up to the last 13 months, forecast how much you are likely to spend for the next 3 months, and get recommendations for which Reserved Instances to purchase.

If you have many accounts and have enabled consolidated billing for AWS Organizations, you can use AWS Cost Explorer to view costs across all your linked accounts. You can also monitor the individual daily and monthly spend for each linked account.

AWS Budgets



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aws re/start

AWS Budgets enables you to set custom budgets that alert you when costs or usage exceed (or are forecasted to exceed) your budgeted amount. AWS Budgets uses the cost visualization that is provided by Cost Explorer to show you the status of your budgets and to provide forecasts of your estimated costs. You can also use Budgets to create notifications if you go over your budgeted amounts, or when your estimated costs exceed your budgets. Budgets can be tracked at the monthly, quarterly, or yearly level. You can customize the start and end dates. Budget alerts can be sent through email or through an Amazon Simple Notification Service (Amazon SNS) topic.

The example highlights the alert notification that was generated by AWS Budgets when a budget threshold was exceeded. In this case, the alert was triggered because actual costs exceeded 80 percent of the budget, and one person was notified as a result.

AWS Cost and Usage Reports

View and publish detailed cost and usage data.

BILLS | COST EXPLORER | BUDGETS | **REPORTS**

Product Code	Usage Type	Operation	Availability Zone	Usage Amount	Currency Code	Line Item Description
Amazon S3	Requests – Tier 1	ListAllMyBuckets		2	USD	\$0.00 per request – PUT, COPY, POST, LIST under the global free tier
Amazon EC2	USW2-Boxusage:t2.micro	Runinstnaces:0002	us-west-2a	1	USD	\$0.00 per Windows t2.micro instance-hour under monthly free tier
Amazon S3	Requests – Tier 1	ListAllMyBuckets		2	USD	\$0.00 per request – PUT, COPY, POST, LIST under the global free tier
Amazon EC2	USW2-Boxusage:t2.micro	Runinstnaces:0002	us-west-2a	1	USD	\$0.00 per Windows t2.micro instance-hour under monthly free tier
Amazon S3	Requests – Tier 1	ListAllMyBuckets		2	USD	\$0.00 per request – PUT, COPY, POST, LIST under the global free tier
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The *AWS Cost and Usage Reports* page is a single location for accessing comprehensive information about your AWS costs and usage. You can use it to generate reports that contain line items for each unique combination of AWS products, usage type, and operation that you use in your AWS account. You can customize the generated reports to aggregate the information either by the hour or by the day. You can also publish your AWS billing reports to an *Amazon Simple Storage Service (Amazon S3) bucket*, and AWS will update the reports in your bucket once a day.

Amazon CloudWatch billing alarms



- Generate an alert when estimated charges exceed a specified threshold
- Enabled in the AWS Management Console
- Must be created in the us-east-1 Region
 - Central storage for all billing metrics
- Based on metrics that includes total and service-specific charges
- Send email notifications through an Amazon Simple Notification Service (Amazon SNS) topic

You can monitor your estimated AWS charges by using Amazon CloudWatch to generate an alert when your charges exceed a specified threshold. When you enable the monitoring of estimated charges for your AWS account, the estimated charges are calculated and sent several times daily to CloudWatch as metric data.

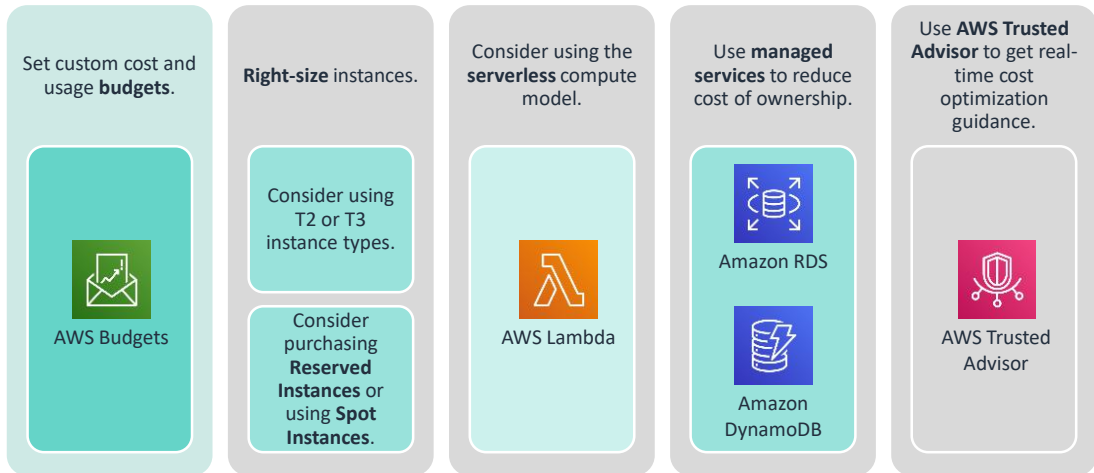
Billing metric data is stored in the US East (Northern Virginia) Region and represents worldwide charges. This data includes the estimated charges for every AWS service that you use, in addition to the estimated overall total of your AWS charges.

The alarm triggers when your account billing exceeds the threshold that you specify. It triggers only when the actual billing exceeds the threshold. It does not use projections that are based on your usage during the month.

If you create a billing alarm when your charges have already exceeded the threshold, the alarm immediately goes to the *ALARM* state.

Alarm notifications are sent to an email address through an SNS topic.

Designing for cost reduction



For more information about cost optimization, refer to the [Cost Optimization Pillar](#) in the AWS Well-Architected Framework.

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With the aid of cost management tools, you can devise a cost-reduction strategy for your AWS services. A good strategy includes the listed cost-optimization principles:

- Set custom cost and usage budgets. This practice enables you to better follow the *Pay only for what you need, when you need it* principle of cloud computing.
- Right-size instances –
 - Consider using T2 or T3 instances for workloads that occasionally need to burst to full core performance. These instances are designed to provide a baseline level of CPU performance with the ability to burst to a higher level when it is required by your workload. T3 instances feature the latest Intel Xeon Scalable processors—which, result in up to a 30 percent better price-to-performance improvement over T2 instances.
 - Consider purchasing Reserved Instances for groups of long-running instances.
 - Use Spot Instances for batch-processing jobs and to get the best price. Use Spot Instance history reports to fine-tune bid requests.
- Consider using AWS Lambda. The serverless model enables you to run code without provisioning or managing servers, and you pay only for the compute time that you consume. You are not charged when your code is not running.
- Use managed services. In the cloud, managed services—such as Amazon S3 and Amazon Relational Database Service (Amazon RDS)—remove the operational

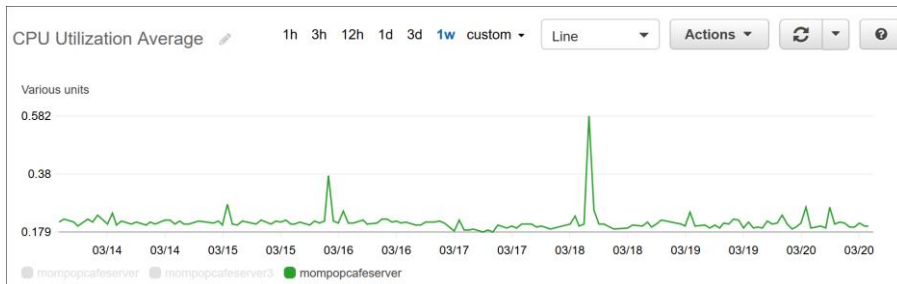
burden of maintaining servers and operating at cloud scale. They also offer a lower cost per transaction or service.

- Use AWS Trusted Advisor to get specific advice about how to reduce cost.

Finding and eliminating waste

Locate and eliminate waste by:

- Using **Amazon CloudWatch** metrics to find long-running idle instances.
 - Sometimes, unneeded resources are still running.
- Using **AWS Cost Explorer** to find the costs that are associated with entire projects or initiatives.



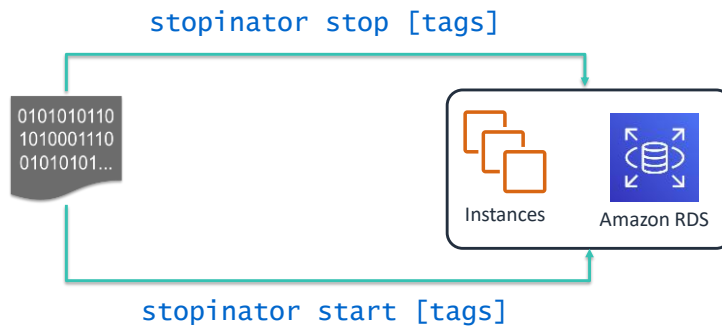
Another effective cost-reduction technique is to find and eliminate waste. For example, the ease of provisioning resources can sometimes lead to situations where unneeded resources are running. You can use Amazon CloudWatch metrics and CloudWatch alarms to find those long-running idle instances and shut them down. A CloudWatch utilization graph, such as the example, can help identify instances that are idle or rarely used.

You can also use AWS Cost Explorer to find the costs that are associated with entire projects or initiatives. AWS Cost Explorer can help you identify the most costly projects, and prioritize which projects should be examined first for cost-reduction opportunities.

Using a stopinator script

Use a *stopinator* script:

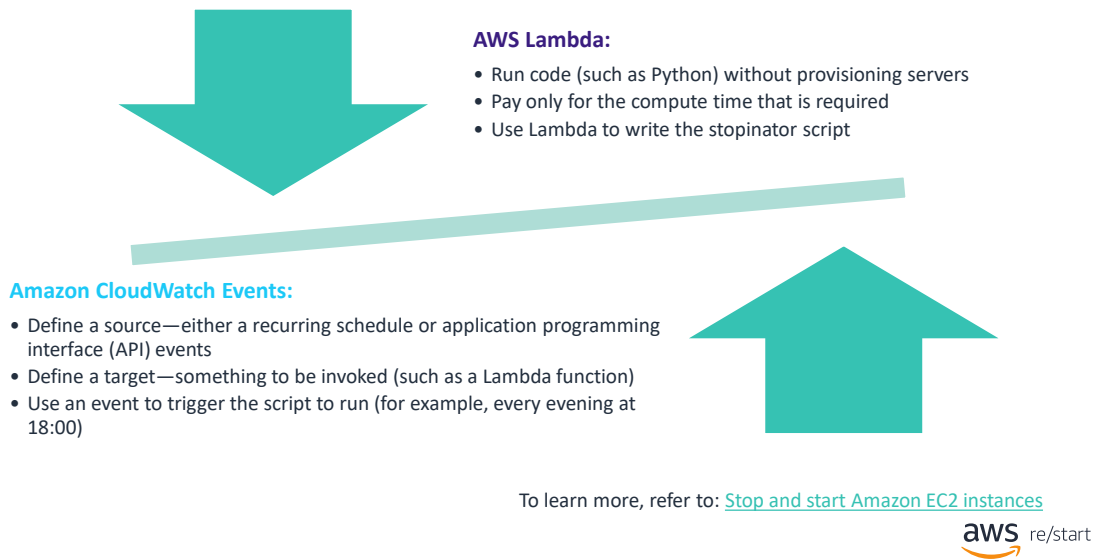
- Turn on and turn off selected AWS resources
- Is a best practice to reduce cost



Writing and using a *stopinator* script is a technique for automating the shutdown of instances. A *stopinator* is a generic term for any script or application that is written against the AWS Cloud, and that looks for and stops unused instances.

These scripts are typically set up to run during the evenings and on weekends. Using a stopinator can result in significant cost savings to an organization, which can free your cloud computing budget for new projects. It is also a useful dual function utility script because it is typically designed to enable you to start resources when you need them (for example, at the beginning of the workday).

Serverless stopinator

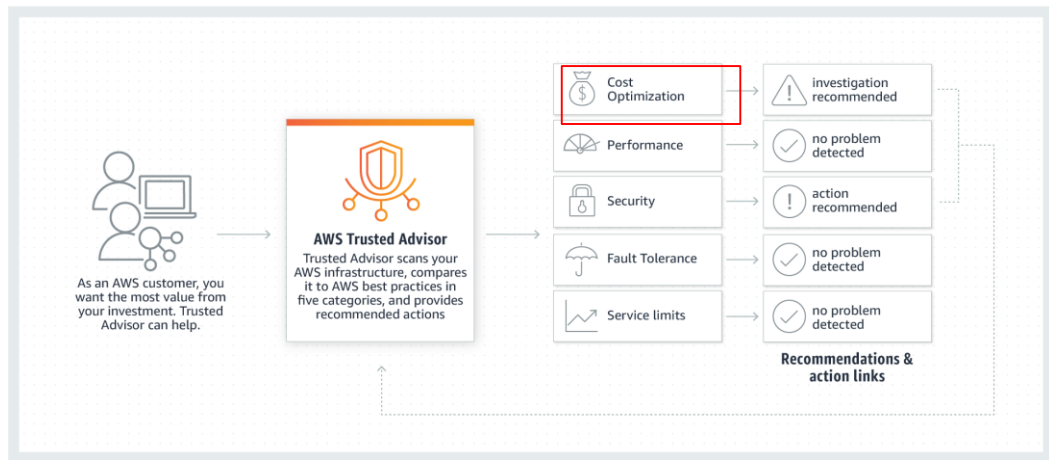


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You do not need to create or use an Amazon Elastic Compute Cloud (Amazon EC2) instance to run a stopinator. A simple and efficient design is to use a combination of a Lambda function and an Amazon CloudWatch Events event in a serverless solution. The logic to stop and start an instance is implemented as a Lambda function. This function is then triggered by a CloudWatch Events event according to the desired schedule.

For a complete example of a serverless stopinator, refer to the resource within the presentation.

What is AWS Trusted Advisor?



To learn more, refer to: [AWS Trusted Advisor](#)



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AWS Trusted Advisor is an online resource to help you reduce cost, increase performance, and improve security by optimizing your AWS environment. AWS Trusted Advisor analyzes your AWS environment and provides recommendations for best practices in five categories:

- **Cost optimization** – Advice about how you can save money by eliminating unused and idle resources, or making commitments to reserved capacity.
- **Performance** – Advice about how to improve the performance of your services by checking your service limits, ensuring that you use provisioned throughput, and monitoring for overutilized instances.
- **Security** – Advice about how to improve the security of your applications by closing gaps, enabling various AWS security features, and examining your permissions.
- **Fault tolerance** – Advice about how to increase the availability and redundancy of your AWS applications by using automatic scaling, health checks, Multi-AZ deployment, and backup capabilities.
- **Service limits** – Advice about the services whose usage exceeds 80 percent of their service limit.

AWS Trusted Advisor cost optimization features

- Sample cost optimization checks –
 - Idle resources, such as Amazon Elastic Compute Cloud (Amazon EC2) instances, Amazon Relational Database Service (Amazon RDS) instances
 - Underused load balancers and volumes
 - Unused Elastic IP addresses
- Use cost-optimization checks to achieve a base level of cost savings
- Core checks and recommendations are available to all customers
- Additional checks and recommendations are available with Business Support or Enterprise Support plans



AWS Trusted Advisor

You can use AWS Trusted Advisor to identify idle resources, such as EC2 instances, underused load balancers and volumes, and unused Elastic IP addresses. Trusted Advisor is also a good tool for cost optimization. It provides checks and recommendations that enable you to achieve cost savings.

AWS Trusted Advisor offers high-level support plans—Business Support and Enterprise Support—which provide additional checks and recommendations.

AWS Trusted Advisor recommendations



Underutilized Amazon EBS Volumes

Checks Amazon Elastic Block Store (Amazon EBS) volume configurations and warns when volumes appear to be underused.

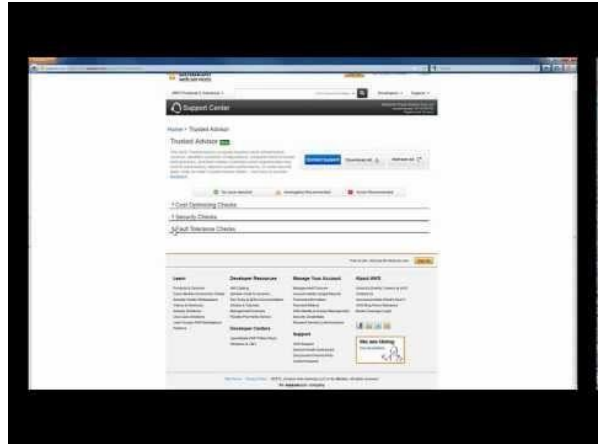
4 of 7 EBS volumes appear to be underutilized. Monthly savings of up to \$1530.20 are available by minimizing underused EBS volumes.

To learn more, refer to: [AWS Trusted Advisor best practice checklist](#).

AWS Trusted Advisor analyzes your AWS environment and provides recommendations for best practices. Recommendations include links to take direct action. AWS Trusted Advisor's real-time guidance helps you provision your resources according to AWS best practices.

Video demonstration

AWS Trusted Advisor



On the Amazon Web Services channel on YouTube, you can access the [How do I start using Trusted Advisor?](#)



Note: Be aware that this video is older (it was created on November 21, 2012).

Key takeaways



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- AWS billing and cost management services and tools can help you **access, understand, allocate, control**, and **optimize your AWS costs and usage**.
- These tools and services include:
 - **AWS Bills**
 - **AWS Cost Explorer**
 - **AWS Budgets**
 - **AWS Cost and Usage Reports**
 - **AWS Trusted Advisor**
- **Automated scripts** can be used to **reduce waste and costs**. A **serverless model** is an **efficient way** to implement a **schedule-based script**.

aws re/start

Some key takeaways from this lesson include:

- AWS billing and cost management services and tools can help you access, understand, allocate, control, and optimize your AWS costs and usage.
- These tools and services include:
 - AWS Bills
 - AWS Cost Explorer
 - AWS Budgets
 - AWS Cost and Usage Reports
 - AWS Trusted Advisor
- Automated scripts can be used to reduce waste and costs. A serverless model is an efficient way to implement a schedule-based script.