



# Workload Optimization with No Architectural Changes

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# Agenda

- What are we solving for?
- Plan of action
- Tools for the Job
- Diving into:
  - Amazon Elastic Block Store (Amazon EBS)
  - Amazon Relational Database Service (Amazon RDS) / Amazon Aurora
  - Amazon Elastic Compute Cloud (Amazon EC2)
- Where to start?

# What are we solving for?

- Cost Optimization
- Increased Performance
- Minimal Engineering Bandwidth
- No Architectural Changes



# Plan of Action

1. Moving Amazon EBS gp2 to gp3
2. Backing up Amazon RDS and Aurora with Graviton-based Amazon EC2 instances
3. Migrating Linux-based Workloads to Graviton-based Amazon EC2 instances

# Tools for the Job

- AWS Pricing Calculator
- AWS Console or CLI
- Porting Advisor for Graviton
- Cost Explorer



# Amazon Elastic Block Store: gp2 to gp3



# Why gp2 to gp3?

- Up to 20% Savings
- Provisioned IOPS
- Elastic Volumes
- High Performance



Amazon Elastic Block Store (Amazon EBS)

# How to Transition from gp2 to gp3?

The screenshot displays the AWS Management Console interface for the 'Volumes' page. The left-hand navigation pane shows the 'Elastic Block Store' section with 'Volumes' highlighted. The main content area shows a table with one volume of type 'gp2'. The 'Actions' menu is open, and the 'Modify volume' option is highlighted with a red box. Below the table, the 'Details' section for the selected volume is visible, showing fields for Volume ID, Size, Type, and Volume status.

Name	Volume ID	Type	Throughput
-	vol-	gp2	-

Volume ID: vol-  
Details | Status checks | Monitoring | Tags

Volume ID	Size	Type	Volume status
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# How to Transition from gp2 to gp3?

The screenshot shows the AWS Management Console interface for the 'Modify volume' page. The breadcrumb navigation indicates the path: EC2 > Volumes > [Volume ID] > Modify volume. The page title is 'Modify volume' with an 'Info' link. Below the title is a subtitle: 'Modify the type, size, and performance of an EBS volume.'

The 'Volume details' section contains the following fields:

- Volume ID:** A text field containing 'vol-' with a copy icon.
- Volume type:** A dropdown menu with the following options:
  - General Purpose SSD (gp3) (selected, highlighted with a red box and a blue checkmark)
  - General Purpose SSD (gp2)
  - Provisioned IOPS SSD (io1)
  - Provisioned IOPS SSD (io2)
  - Magnetic (standard)
- Throughput (MiB/s):** A text field containing '125'.

Below the dropdown menu, there is a note: 'Min: 3000 IOPS, Max: 16000 IOPS. The value must be an integer.'

Below the throughput field, there is a note: 'Min: 125 MiB, Max: 1000 MiB. Baseline: 125 MiB/s.'

At the bottom right of the 'Volume details' section, there are two buttons: 'Cancel' and 'Modify'.

The footer of the console includes: 'Console Drawer', 'Feedback', 'Language', '© 2023, Amazon Web Services, Inc. or its affiliates.', 'Privacy', 'Terms', and 'Cookie preferences'.

# How to Transition from gp2 to gp3?

The screenshot shows the AWS console interface for modifying an EBS volume. The breadcrumb navigation indicates the path: EC2 > Volumes > Modify volume. The main heading is 'Modify volume' with an 'Info' link. Below the heading is a sub-heading 'Volume details' and a description: 'Modify the type, size, and performance of an EBS volume.'

The 'Volume details' section contains the following fields:

- Volume ID:** A text field containing 'vol-' with a copy icon to its left.
- Volume type:** A dropdown menu currently set to 'General Purpose SSD (gp3)' with an 'Info' link.
- Size (GIB):** A text input field containing the value '8', highlighted with a red box. Below it, a note reads: 'Min: 1 GiB, Max: 16384 GiB. The value must be an integer.'
- IOPS:** A text input field containing the value '3000', highlighted with a red box. Below it, a note reads: 'Min: 3000 IOPS, Max: 16000 IOPS. The value must be an integer.'
- Throughput (MiB/s):** A text input field containing the value '125', highlighted with a red box. Below it, a note reads: 'Min: 125 MiB, Max: 1000 MiB. Baseline: 125 MiB/s.'

At the bottom right of the form area, there are two buttons: 'Cancel' and 'Modify' (which is highlighted in orange).

The footer of the console includes: 'Console Drawer', 'Feedback', 'Language', '© 2023, Amazon Web Services, Inc. or its affiliates.', 'Privacy', 'Terms', and 'Cookie preferences'.

# Expected Savings Example

The screenshot shows the AWS Pricing Calculator interface for configuring Amazon Elastic Block Store (EBS). The configuration is as follows:

- Number of volumes: 150
- Average duration each instance runs: 730 hours per month
- Storage for each EC2 instance: General Purpose SSD (gp2)
- Storage amount per volume: 1 TB
- Snapshot Frequency: No snapshot storage

At the bottom, the cost summary is displayed:

- Total Upfront cost: 0.00 USD
- Total Monthly cost: 15,360.00 USD

Buttons for "Show Details", "Save and view summary", and "Save and add service" are visible.

The screenshot shows the AWS Pricing Calculator interface for configuring Amazon Elastic Block Store (EBS). The configuration is as follows:

- Number of volumes: 150
- Average duration each instance runs: 730 hours per month
- Storage for each EC2 instance: General Purpose SSD (gp3)
- Storage amount per volume: 1 TB
- Provisioning IOPS per volume (gp3): 3000

At the bottom, the cost summary is displayed:

- Total Upfront cost: 0.00 USD
- Total Monthly cost: 12,288.00 USD

Buttons for "Show Details", "Save and view summary", and "Save and add service" are visible.



# Expected Savings Example

Amazon EBS								
#	Region	EBS Volume Type (Assuming 1TB individual volumes)	# of Volumes	Price (Monthly)	Optimization Opportunities	EBS Volume Type (Assuming 1TB individual volumes)	# of Volumes	Price (Monthly)
1	us-east	General Purpose SSD (GP2)	150	\$ 15,360.00		General Purpose SSD (GP3)	150	\$ 12,288.00
Total Cost (Monthly)				\$ 15,360.00				\$ 12,288.00
Total Potential Savings (Monthly)								\$ 3,072.00
Yearly Savings								\$ 36,864.00

# Using Graviton-based Amazon EC2 instances with Amazon RDS & Amazon Aurora

# Why use Graviton with Amazon RDS and Aurora?

- Price Performance
- No Porting or Code Changes
- Key Specs
- Compatibility



Amazon Relational Database Service (Amazon RDS)

# Identifying Swappable Instances & Implementation

1. Pricing Calculator
2. Note Current Instance Specs
3. Determine Graviton Alternative
4. Implementation

# Step 1: AWS Pricing Calculator

The screenshot shows the 'Select service' step of the AWS Pricing Calculator. The interface includes a search bar where 'Amazon RDS for MySQL' is entered. Below the search bar, a card for 'Amazon RDS for MySQL' is displayed, featuring a 'Configure' button. The top navigation bar shows 'English' and 'Contact Sales' options. The bottom summary bar indicates a total cost of 0.00 USD for 12 months.

aws pricing calculator English Contact Sales Feedback

AWS Pricing Calculator > My Estimate > Add service

Step 1 Select service

Step 2 Configure service

**Select service** Info Bulk import

**AWS services (1)** Cancel

Search by location type  
See the services that are available in your region, wave length zone, and local zone.

Search all services  
Choose a service or workload to configure an estimate.

Choose a location type Info Choose a Region

Region US East (N. Virginia)

Find Service

Q Amazon RDS for MySQL X

**Amazon RDS for MySQL**

MySQL is the world's most popular open source relational database. Amazon RDS makes it easy to set up, operate, and scale MySQL deployments in the cloud.

Product page **Configure**

Upfront cost: 0.00 USD Monthly cost: 0.00 USD Total 12 months cost 0.00 USD (Includes upfront cost) View summary

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The screenshot shows the 'Configure Amazon RDS for MySQL' step. The 'MySQL instance specifications' section is active, showing a quantity of 1 and the instance type 'db.m1.large'. The 'vCPU: 2' and 'Memory: 7.5 GiB' are also displayed. The 'Utilization (On-Demand only)' section is set to 100% utilized per month. The 'Deployment option' is set to 'Multi-AZ' and the 'Pricing model' is 'OnDemand'. The bottom summary bar shows a total upfront cost of 0.00 USD and a total monthly cost of 335.80 USD.

aws pricing calculator English Contact Sales Feedback

**Configure Amazon RDS for MySQL** Info X

**MySQL instance specifications** Info

Quantity

1

Q db.m1.large X

Selected Instance:

**db.m1.large**

**vCPU: 2 Memory: 7.5 GiB**

**Utilization (On-Demand only)**  
With utilization, you still have to stop the instance to get the cost benefit. Utilization only affects OnDemand pricing for instances and not the storage, backups, etc.

100 %Utilized/Month

Deployment option

Multi-AZ

Pricing model

OnDemand

**Total Upfront cost: 0.00 USD** Show Details **Total Monthly cost: 335.80 USD** Save and view summary Save and add service

Acknowledgment

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# Step 2: Note Current Instance Specs

The screenshot shows the 'Configure Amazon RDS for MySQL' configuration window in the AWS Pricing Calculator. The window is titled 'Configure Amazon RDS for MySQL' and includes a close button (X) and an information icon (i). The configuration is as follows:

- MySQL instance specifications** (Info link):
  - Quantity: 25
  - Instance type: db.r5.2xlarge
  - Selected Instance: db.r5.2xlarge
    - vCPU: 8
    - Memory: 64 GiB
- Utilization (On-Demand only)**:
  - With utilization, you still have to stop the instance to get the cost benefit. Utilization only affects OnDemand pricing for instances and not the storage, backups, etc.
  - Utilization percentage: 100
  - Utilization unit: %Utilized/Month
- Deployment option**: Multi-AZ
- Pricing model**: OnDemand

At the bottom of the configuration window, the costs are displayed:

- Total Upfront cost: 0.00 USD
- Total Monthly cost: 35,040.00 USD

Buttons for 'Show Details', 'Save and view summary', and 'Save and add service' are also visible.



# Step 3: Determine Graviton Alternative

The screenshot shows the 'Configure Amazon RDS for MySQL' configuration window. The region is set to 'US East (N. Virginia)'. Under 'MySQL instance specifications', the quantity is 25. A search bar contains 'db.r6g'. A list of instance types is shown, with 'db.r6g.2xlarge' highlighted and its specifications (vCPU: 8, Memory: 64 GiB) circled in red. At the bottom, the total costs are: Total Upfront cost: 0.00 USD, Total Monthly cost: 8,395.00 USD. Buttons for 'Show Details', 'Save and view summary', and 'Save and add service' are visible.

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Configure Amazon RDS for MySQL Info

Region US East (N. Virginia)

MySQL instance specifications Info

Quantity 25

db.r6g.2xlarge vCPU: 8 Memory: 64 GiB

db.r6g.16xlarge vCPU: 64 Memory: 512 GiB

db.r6g.4xlarge vCPU: 16 Memory: 128 GiB

db.r6g.8xlarge vCPU: 32 Memory: 256 GiB

db.r6g.large vCPU: 2 Memory: 16 GiB

db.r6g.xlarge vCPU: 4 Memory: 32 GiB

Show calculations

Total Upfront cost: 0.00 USD  
Total Monthly cost: 8,395.00 USD

Show Details Save and view summary Save and add service

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The screenshot shows the 'Configure Amazon RDS for MySQL' configuration window. The quantity is 25. The search bar contains 'db.r6g.2xlarge'. The 'Selected Instance' section shows 'db.r6g.2xlarge' with 'vCPU: 8' and 'Memory: 64 GiB' circled in red. The 'Utilization (On-Demand only)' is set to 100% Utilized/Month. The 'Deployment option' is set to 'Multi-AZ' and the 'Pricing model' is set to 'OnDemand'. At the bottom, the total costs are: Total Upfront cost: 0.00 USD, Total Monthly cost: 31,353.50 USD. Buttons for 'Show Details', 'Save and view summary', and 'Save and add service' are visible.

aws pricing calculator English Contact Sales Feedback

Configure Amazon RDS for MySQL Info

Quantity 25

db.r6g.2xlarge

Selected Instance:  
db.r6g.2xlarge  
vCPU: 8 Memory: 64 GiB

Utilization (On-Demand only)  
With utilization, you still have to stop the instance to get the cost benefit. Utilization only affects OnDemand pricing for instances and not the storage, backups, etc.  
100 %Utilized/Month

Deployment option Multi-AZ

Pricing model OnDemand

Total Upfront cost: 0.00 USD  
Total Monthly cost: 31,353.50 USD

Show Details Save and view summary Save and add service

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# Step 4: High-Level Implementation

1. Upgrade the database (if necessary)
2. Modify the instance types
3. Validate Application Performance
4. Rollback (if required)

To learn more read: **Key Considerations in moving to Graviton2 for Amazon RDS and Amazon Aurora databases**

<https://aws.amazon.com/blogs/database/key-considerations-in-moving-to-graviton2-for-amazon-rds-and-amazon-aurora-databases/>

# Expected Savings Example

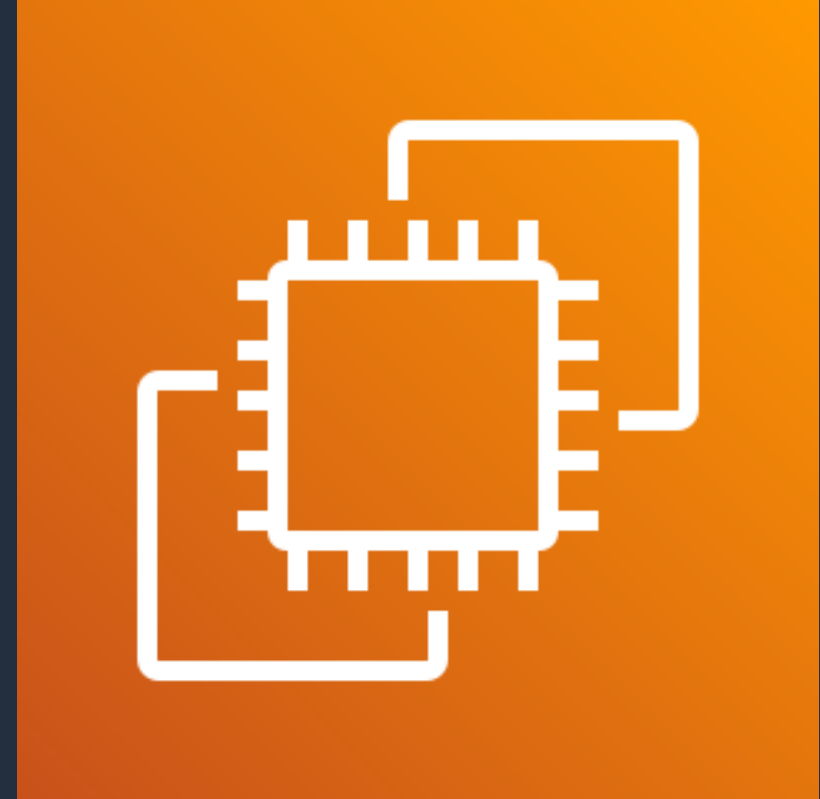
Plan	Region	engine	nodes	dbInstanceClass	vCPU	Memory - GiB	Network Performance - Gigabit	Price Per Month	Optimization Opportunities	dbInstanceClass	vCPU	Memory - GiB	Network Performance - Gigabit	Price Per Month	Savings Per Engine (Monthly)	
On-Demand	us-east	Amazon Aurora-MySQL	25	db.r5.2xlarge	8	64	Up to 10	\$ 21,170.00		db.r6g.2xlarge	8	64	Up to 10	\$ 18,943.00	\$ 2,227.00	
On-Demand	us-east	Amazon RDS for MySQL	25	db.r5.2xlarge	8	64	Up to 10	\$ 35,127.60		db.r6g.2xlarge	8	64	Up to 10	\$ 31,441.10	\$ 3,686.50	
Price (Monthly)														\$ 56,297.60	\$ 50,384.10	
Total Savings (Monthly)														\$ 5,913.50		
Total Savings (Yearly)														\$ 70,962.00		

# Leveraging Graviton for Linux Workloads



# Why use Graviton for Linux Workloads?

- Up to 40% better price-to-performance
- Enhanced Security
- Extensive Software Support
- Energy Efficient



Amazon Elastic Compute  
Cloud (Amazon EC2)

# Identifying the Right Instance Swap

aws pricing calculator English Contact Sales Feedback

Step 2  
Configure service

**AWS services (6)** Cancel ⓘ

Search by location type  
See the services that are available in your region, wave length zone, and local zone.

Search all services  
Choose a service or workload to configure an estimate.

Choose a location type [Info](#)

Choose a Region

Region

US East (N. Virginia)

Find Service

**Amazon EC2**

Amazon EC2 provides a wide selection of instance types optimized to fit different use cases. Instance types comprise varying combinations of CPU, memory, storage, and networking capacity and give you the flexibility to choose the appropriate mix of resources for your applications.

[Product page](#)

**Windows Server and SQL Server on Amazon EC2**

The Windows Server and SQL Server on Amazon EC2 calculator provides a pricing estimate for specific workloads. It recommends suitable cloud deployment options and cost-saving pricing models based on licensing and infrastructure inputs.

[Product page](#)

Upfront cost: 0.00 USD Monthly cost: 0.00 USD Total 12 months cost **0.00 USD**

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**Configure Amazon EC2** Info ⓘ

**EC2 Instances (580)**

Based on your inputs, this is the lowest-cost EC2 instance: **t4g.nano**

Chosen instance: **t4g.nano** | Family: **t4g** | **2vCPU** | **0.5 GiB Memory**

Search instance type

Instance family [Info](#) vCPUs Memory (GiB) Network performance

Any Instance fa...  Any vCPUs  Any Memory (GiB)  Any Network Pe...

Show only current generation instances.

< 1 2 3 4 5 6 7 ... 58 > ⚙️

Instance name	vCPUs	Memory	Network Performance	Storage
<input checked="" type="radio"/> <b>t4g.nano</b>	2	0.5 GiB	Up to 5 Gigabit	EBS only
<input type="radio"/> t3a.nano	2	0.5 GiB	Up to 5 Gigabit	EBS only
<input type="radio"/> t3.nano	2	0.5 GiB	Up to 5 Gigabit	EBS only

Total Upfront cost: 0.00 USD  
Total Monthly cost: 0.00 USD [Show Details](#)

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# AWS Graviton ease of adoption

Difficulty	Workload	Actions
Virtually no effort	Amazon RDS, Aurora, ElastiCache, OpenSearch Service, MemoryDB & Neptune	Upgrade to latest and enjoy
Super easy	Amazon EMR	Typically, just works
Pretty easy	AWS Lambda	Typically, just works with Lambda managed runtimes or base images. Watch: JNI or Python-native modules
Quite easy	Linux – Interpreted and JIT'd languages (e.g., Java, PHP, Node.js)	Select ARM64 AMI for Graviton and Install Bonus if containerized Watch: JNI or Python-native modules
More involved	Linux – Compiled languages (e.g., C/C++, Python, Go)	Select ARM64 AMI for Graviton and compile Watch: port any intrinsics or assembly
Some work, high reward	Microsoft Windows – .NET	Migrate to Linux + .NET core on ARM64 AMI for Graviton
Sorry, not yet	Microsoft Windows	Microsoft Windows Server not yet available for Graviton.





# Porting Advisor for Graviton

- Open-Source CLI Tool
- Analyze Source Code
- Accelerate Graviton Transition

Porting Advisor for Graviton v1.0.0

**Project Information**

Project:  
peasy-js-samples

Source root:  
/Users/rdoty/TestApp/peasy-js-samples

Report Date:  
2023-01-30 14:09:30

**Results**

	File	Line #	Comments
🔗			239 files scanned.
🟢			detected go code. min version 1.16 is required. version 1.18 or above is recommended. we detected that you have version 1.18. see <a href="https://github.com/aws/aws-graviton-getting-started/blob/main/golang.md">https://github.com/aws/aws-graviton-getting-started/blob/main/golang.md</a> for more details.
🟢			detected java code. we recommend using Corretto. see <a href="https://aws.amazon.com/corretto/">https://aws.amazon.com/corretto/</a> for more details.
🟢			detected python code. if you need pip, version 19.3 or above is recommended. we detected that you have version 22.2.2.
🟢			detected python code. min version 3.7.5 is required. we detected that you have version 3.10.7. see <a href="https://github.com/aws/aws-graviton-getting-started/blob/main/python.md">https://github.com/aws/aws-graviton-getting-started/blob/main/python.md</a> for more details.
🔴	/Users/rdoty/TestApp/peasy-js-samples/porting-advisor-for-graviton/sample-projects/go-samples/incompatible/go.mod		using dependency library github.com/golang/snappy version 0.0.1. upgrade to at least version 0.0.2
🔴	/Users/rdoty/TestApp/peasy-js-samples/porting-advisor-for-graviton/sample-projects/java-samples/pom.xml		dependency library: leveledbjni-all is not supported on Graviton
🔴	/Users/rdoty/TestApp/peasy-js-samples/porting-advisor-for-graviton/sample-projects/java-samples/pom.xml		using dependency library snappy-java version 1.1.3. upgrade to at least version 1.1.4
🔴	/Users/rdoty/TestApp/peasy-js-samples/porting-advisor-for-graviton/sample-projects/java-samples/pom.xml		using dependency library zstd-jni version 1.1.0. upgrade to at least version 1.2.0
🔴	/Users/rdoty/TestApp/peasy-js-samples/porting-advisor-for-graviton/sample-projects/python-samples/incompatible/requirements.txt	3	using dependency library openblas version 0.3.16. upgrade to at least version 0.3.17
⚠️	/Users/rdoty/TestApp/peasy-js-samples/porting-advisor-for-graviton/sample-projects/java-samples/pom.xml		using dependency library hadoop-lzo. this library requires a manual build more info at: <a href="https://github.com/aws/aws-graviton-getting-started/blob/main/java.md#building-multi-arch-jars">https://github.com/aws/aws-graviton-getting-started/blob/main/java.md#building-multi-arch-jars</a>
⚠️	/Users/rdoty/TestApp/peasy-js-samples/porting-advisor-for-graviton/sample-projects/python-samples/incompatible/requirements.txt	5	dependency library numpy is present. min version 1.19.0 is required.
⚠️			detected java code. min version 8 is required. version 11 or above is recommended. see <a href="https://github.com/aws/aws-graviton-getting-started/blob/main/java.md">https://github.com/aws/aws-graviton-getting-started/blob/main/java.md</a> for more details.



# Expected Savings Example

#	Instance Type (Linux)	Nodes	vCPU - Cores	Memory - GiB	Network Performance	Price (On-Demand Monthly)	Optimization Opportunities	Instance Type (Linux)	Nodes	vCPU - Cores	Memory - GiB	Network Performance	Price (On-Demand Monthly)	Price (Compute Savings Plan - 1yr Reservation) - All Upfront (monthly pay equivalent)	Price (Compute Savings Plan - 3yr Reservation) - All Upfront (monthly pay equivalent)
1	t3.large	25	2	8	Up to 5	\$ 1,518.40		t4g.large	25	2	8	Up to 5	\$ 1,226.40	\$ 824.90	\$ 552.98
2	c5.xlarge	25	4	8	Up to 10	\$ 3,102.50		a1.xlarge	25	4	8	Up to 10	\$ 1,861.50	\$ 1,259.25	\$ 839.50
3	r5.xlarge	25	4	32	Up to 10	\$ 4,599.00		r6g.xlarge	25	4	32	Up to 10	\$ 3,679.20	\$ 2,489.30	\$ 1,744.70
5	m5.2xlarge	25	8	32	Up to 10	\$ 7,008.00		m6g.2xlarge	25	8	32	Up to 10	\$ 5,621.00	\$ 3,863.53	\$ 2,646.25
<b>Total Cost (Montly)</b>						<b>\$ 16,227.90</b>							<b>\$ 12,388.10</b>	<b>\$ 8,436.98</b>	<b>\$ 5,783.43</b>
<b>Total Potential Savings (Monthly)</b>													<b>\$ 3,839.80</b>	<b>\$ 7,790.93</b>	<b>\$ 10,444.48</b>
<b>Total Potential Savings (Yearly)</b>													<b>\$ 46,077.60</b>	<b>\$ 93,491.10</b>	<b>\$ 125,333.70</b>



# Take Action

1. gp2 to gp3
2. Swap Amazon RDS/Amazon Aurora to use Graviton
3. Linux workloads to Graviton

To learn more read: **Optimize AWS costs without architectural changes or engineering overhead**

<https://aws.amazon.com/blogs/aws-cloud-financial-management/optimize-aws-costs-without-architectural-changes-or-engineering-overhead/>



# Thank you!

Ryan Doty

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