Bring your own script to the cloud

This tutorial explains how you can create and execute a custom script using AWS. AWS supports multiple ways to achieve this. One option, the AWS Lambda compute service, allows you to run code without provisioning or managing servers. It executes your code only when needed and scales automatically, from a few requests per day to thousands per second. You pay only for the compute time you consume - there is no charge when your code is not running. With AWS Lambda, you can run code for virtually any type of application or backend service - all with zero administration. AWS Lambda runs your code on a high-availability compute infrastructure and performs all of the administration of the compute resources, including server and operating system maintenance, capacity provisioning and automatic scaling, code monitoring and logging.

Using the Lambda Function

You can use AWS Lambda to run your code in response to events, such as changes to data in an Amazon S3 bucket or an Amazon DynamoDB table; to run your code in response to HTTP requests using Amazon API Gateway; or invoke your code using API calls made using AWS Software Development Kits (SDKs). With these capabilities, you can use Lambda to easily build data processing triggers for AWS services like Amazon S3 and Amazon DynamoDB, process streaming data stored in Kinesis, or create your own back end that operates at AWS scale, performance, and security.

Create a Lambda function

- 1. Sign into the <u>AWS Management Console</u>.
- 2. Navigate to the AWS Lambda Console by typing "Lambda console" in the "Find Services" area of the Management Console (see Figure 8.1).

992	Services - Resource Groups - 🕯			Assentit admin depice & 30
	AWS Manageme	nt Console		
	AWS services			Access resources on the go
	Find Services Visual and enternames, impained or antergen.			Access the Management Canada using the #W5 Canada Mabile App. Learn more Ca
	Q. lambda		×	0
	Lambda Aun Code without Thinking about Servers Amazon Lox			Explore AWS
	Build Votes and Test Dutliets Cardebuild Build and Test Carls			Amazon SageMaker Studio
	107 1-Click Trigger Her's Lambda Lunctions Fram simple devices			The first visual integrated development environment for machine learning. Learn more 🔯
	 All services 			
	(2) Compate EC2 Lightcan (2) ECN	Cf Satelläte Graund Station	Security, Identity, & Compliance UN Newword Access Manager Cognito Cognito Connet Manager	Amazen GuardDuty Protect your AAN accounts and workloads with intelligent threat detection. Learn more [2]
	HKS Lambde Rotch Hastic Reanstalle	Amaton Breket LS	thuarithuly Impector Anazon Macio ⊡ Anns Sargia Sagnichi	AWS IQ Connect with KAYS Cestified third party experts for on- demand consultations and project help. Get stanted [2]
	Sarvenesi Apparation Repository Aufis Outpects RC2 Image Buildler	XWS Auto Scaling ClearPortsation ClearTheil Config	Cardhoat Managanant Sarvica Kay Managamant Sarvica ChiadHSM Directory Sarvica	Proc Digital Training Out access to 155+ solf-paced online courses covering Web products and covides. Later near [2]
	 Storage S3 875 F5x 	OpeNovis Service Catalog Systems Manager KWS AppConfig	Antifact Security Hab Detective	Have feedback?
	Stimage Galenag ANS Deckup	Trusted Advisor Cantool Towor	AWS Cost Management AMS Cost Dislover	Submit feedback to tell us about your

Cloud technology is evolving so fast that it is likely that some details in the primer may no longer match reality when you are trying to use it. If you find mismatches (e.g. broken third-party links), please send them to <u>support@earthdata.gov</u> so that we can feed them into the next release of the primer.



www.nasa.gov





If this is the first time you have navigated to the AWS Lambda Console, you will see the page shown in Figure 8.2.

BWS Samices + Resource Groups + 1+	💭 Navaneti-slika-dişkiy 0 38., + N. California + Support +
COMPUTE	
AWS Lambda lets you run code without thinking about servers. ^{Vis age with the actuate the head you can see - when you can be not vertex. ^{Vis age with the the actuate the head you can see - when you can be not vertex.}}	Get started Author a Landod Aurolan from south, or choose from care of many preconfigured examples. Crucke a Aurothin
How it works AIT Cree Ge Jama Mediaji Fythen Roby Contem marine 1 - experts.hoxAlter - sopre General 2 - console.log(event); - { 3 - return Hello from Landool*; 5	
Just write the code Above is a single Lendos function. Clos. "Run" to see function output before going to the next sign	

Figure 8.2

Note: AWS Lambda offers a simple "Hello World" function upon introduction under the **How it works** label and includes a **Run** option (Figure 8.1), allowing you to invoke the function as a general introduction.

3. Create a function on the Lambda Functions list page by clicking on **Create Function** (Figure 8.3), to go to the *Create function* page.

aws Services +	Resource Groups 🗸 🚯 🗘 🕹 Lī_CDDIS 👻 N. Virginia 👻 Support 👻	
AWS Lambda \times	Lambda > Functions	١
Dashboard Applications Functions Layers	Functions (0) C Actions Create function Q. Filter by tags and attributes or search by keyword I I I Function name Description Runtime Code size Last modified	
	There is no data to display.	

Figure 8.3

4. Choose **Author from scratch** on the *Create function* page (Figure 8.4)

aws Service	es 🗸 Resource Groups 🖌 🛠	🛕 🖁 LT_CDDIS 👻 N. Virginia 👻 Support 👻	
AWS Lambda \times	Lambda > Functions		١
Dashboard Applications <mark>Functions</mark> Layers	Functions (0) Q Filter by tags and attributes Function name	C Actions Create function is or search by keyword I I Description Runtime Code size Last modified	
		There is no data to display.	

Figure 8.4

- 5. Give your Lambda function a name under **Basic information**.
- 6. Choose Python 3.7 from the drop-down list labeled **Runtime**.

7. Reveal the options under **Choose or create an execution role** by clicking on the arrow to the left of the words. You will then see the options shown in Figure 8.5.

▼ Choose or create an execution role		
Execution role Choose a calculated the point of your function. To create a custom role, go to the IAM console. O Create a new role with basic Lambda permissions		
O Use an existing role		
Role creation might take a few minutes. The new role will be scoped to the current function. To use it with other functions, you can modify it in the IAM console.		
Lambda will create an execution role named <myfunctionname>-role-305qdizw, with permission to upload logs to Amazon CloudWatch Logs.</myfunctionname>	Cancel	Create function

Figure 8.5

8. Create a new role by selecting **Create new role from AWS policy template(s)** under the Execution role heading to reveal more options (Figure 8.6).

Choose or create an execution role	
ecution role	
iose a role that defines the permissions of your function. To create a custom role, go to the IAM console.	
Create a new role with basic Lambda permissions	
Use an existing role	
Create a new role from AWS policy templates	
Bole creation might take a few minutes. The new role will be scoped to the current function. To use it with other functions, you can modify it in the IAM console.	
ie name	
er a name for your new role.	
nyRoleName	
andu latters numbers bushess or undercorrecuit has respect	
ony texes, homoes, typness, or unversiones which to spokes.	
icy templates - optional Info	
uose one or more policy templates.	
•	
•	
	Cancel Create function

Figure 8.6

9. Enter a name for your new role under Role name. You must provide a name for your role.

Leave the **Policy templates** field blank.

10. Create your function by clicking on the **Create Function** button.

This will automatically create a role and will associate it with your lambda function (permissions required by your lambda function to run)

A new page for your Lambda function will appear containing many options for setting up your function (Figure 8.7).

Successfully created the function TestFunction2 . You can now change its cod	e and configuration. To invoke your fun	ction with a test event, choose "Test".		×
Lambda > Functions > TestFunction2			ARN - arn:aws:lambda:us-east-1:199633825714:function:TestFunction2	
TestFunction2		Throttle Qualifiers v	Actions V Select a test event V Test Save	
Configuration Monitoring				
▼ Designer				
P	FunctionName			
	Sealary Layers	(0)		
+ Add trigger		Amazon CloudWa	tch Logs	
		Resources that the function	s role has access to appear here	
Function code Info				

Figure 8.7

We will not be using triggers in this tutorial, but clicking on the **Add trigger** button in Figure 8.7 will take you to a window with several options from which you can choose to trigger your Lambda function (Figure 8.8)

rigger configur	ration	
Select a trigger		•
Q		
API Gateway api applicati	ion-services aws serverless	
AWS IoT aws devices	iot	
Alexa Skills K alexa iot	lit	
Alexa Smart	Home	_
Application L aws load-ba	Load Balancer Ilancing	
CloudFront aws cdn	edge	
CloudWatch aws events	Events management-tools	
CloudWatch aws logging	Logs management-tools	
CodeCommit		

Figure 8.8

Depending on which service you select, you are prompted to provide relevant information for that service. For example, if you select DynamoDB, you need to provide the following:

- The name of the DynamoDB table
- Batch size
- Starting position

Take a look at the window with the options for setting up your function; the second vertical panel is titled Function Code (toward the bottom of Figure 8.7). Figure 8.9 shows the rest of the panel not seen in Figure 8.7.

Successfully created the function TestFunction2 . You can now change its co	nd configuration. To invoke your function with a test event, choose "Test".	¢
Lambda > Functions > TestFunction2 TestFunction2 Configuration Monitoring	ARN - arrnavs:lambdaus-east-1:199633825714:function:TestFunction2 Throttie Qualifiers Actions Select a test event Test Save	
Designer + Add trigger Function code info	FunctionName	

Figure 8.9

Note the code in the second column; when run, it returns a simple "Hello from Lambda" greeting. The **Handler** field on the top right shows a value of "lambda_function.lambda_handler". This is the filename.handler function. The console saves the sample code in the lambda_function.py file. The function name that receives the event as a parameter when the Lambda function is invoked is in the lambda_handler.

Other configuration options on this page include:

- Environment variables enables you dynamically pass settings to your Lambda functions code and libraries without making changes to your code.
- Tags allows you to attach key-value pairs to AWS resources to better organize them.
- Execution role allows you to administer security on your function, using defined roles and policies or creating new ones.
- Basic settings allows you to dictate the memory allocation and timeout limit for your Lambda function.
- Network allows you to select a VPC (Virtual Private Cloud) your function will access.
- **Debugging and error handling** allows you to select a <u>AWS Lambda Function Dead Letter Queues</u> resource to analyze failed function invocation retries. It also allows you to enable active tracing.
- Concurrency allows you to allocate a specific limit of concurrent executions allowed for this function.
- Auditing and compliance logs function invocations for operational and risk auditing, governance and compliance.

Invoke the Lambda Function and Verify Results, Logs, and Metrics

Follow these steps to invoke your Lambda function using the sample event data provided in the console.1. Click on **Test** on the Function options page (Figure 8.10).

mbda > Functions > TestFunction2			ARN - arn:aws:lambda:us-east-1:199633825714:functio	n:TestFunction2
estFunction2		Throttle Qualifiers	Actions V Select a test event	Test Save
Configuration Monitoring				
▼ Designer				
P	TestFunction2			
	Layers	(0)	
+ Add trigger		Amazon Cloud	Watch Logs	
		Resources that the funct	ion's role has access to appear here	
Function code Info				
Code entry type	Runtime		Handler Info	
Edit code inline 🔻	Python 3.7	•	lambda_function.lambda_handler	

Figure 8.10

2. Click on the circle next to **Create new test event** in the *Configure test event* window (Figure 8.11).

Configure test event	×
A function can have up to 10 test events. The events are persisted so you can switch to another c and test your function with the same events.	omputer or web browser
Create new test event	
Edit saved test events	
Event template	
Hello World	•
Event name	
MyEventName	
1-{ 2 "key1": "value1", 3 "key2": "value2", 4 "key3": "value3"	
5 }	

Figure 8.11

Leave the Hello World option in the Event template field.

3. Enter an **Event name**

In the code section, you can change keys and values in the sample JSON, but don't change the event structure. If you do change any keys and values, you must update the sample code accordingly.

4. Click on Create.

Each user can create up to 10 test events per function. Those test events are not available to other users.

AWS Lambda executes your function on your behalf. The handler in your Lambda function receives and then processes the sample event.

You will then see the window in Figure 8.12

onfiguration Monitoring		Throttle Qualifie	rs V Actions V Select o test event V Test	Sav
¹ Designer				
P	TastEurotion?			
	N restranction2			
	Layers		(0)	
+ Add trigger		Amazon Clo	udWatch Logs	
		Resources that the f	unction's role has access to appear here	
unction code Info				
	Puntima		Handler Info	
ode entry type	Nutrutte			

Figure 8.12

5. Click on **Details** to see the full results.

The **Execution result** section shows the execution status as **succeeded** and also shows the function execution results, returned by the return statement.

The **Summary** section shows the key information reported in the **Log output** section in a nice format. This includes important information such as **memory used and billed duration**.

The Log output section shows the log AWS Lambda generates for each execution.

These are the logs written to CloudWatch by the Lambda function. The AWS Lambda console shows these logs for your convenience.

Note that clicking on the **Click here** link in Figure 8.12 shows logs in the AWS CloudWatch console. The function then adds logs to Amazon CloudWatch in the log group that corresponds to the Lambda function.

Run the Lambda function a few more times by clicking on the Test button to gather some metrics.

View the metrics by selecting the **Monitoring** tab under the green results box (Figure 8.13).

stFunction2		Throttle Qualifiers V Actions V Select a test event V	Test Save
onfiguration Monitoring			
Designer			
P	TestFunction2		
	Layers	(0)	
+ Add trigger		Amazon CloudWatch Logs	
		Resources that the function's role has access to appear here	
unction code Info			
	Runtime	Handler Info	
ode entry type			

Figure 8.12

You will then be able to view metrics about your script executions (Figure 8.14) including

- Number of times invoked
- Duration
- Error count and Success rate (%)
- Number of Throttles
- Iterator Age
- Dead letter errors

You may have to refresh each graph separately using the small dropdown menu in the upper right of each graph (Figure 9.14) after each run to update the graphs.

ambda > Functions > TestFunction2 ARN - amawstambdatus-east-1:199653825				
stFunction2		Throttle Qualifiers	Actions V Select a test event V	Test Save
Configuration Monitoring				
Designer				
60	TestFunction2			
	Eayers	(0)	
+ Add trigger		Amazon Cloud	 Vatch Logs	
		Resources that the funct	ion's role has access to appear here	
function code Info				
ode entry type	Runtime		Handler Info	
	Dathers 7.7	-	lambda function lambda handlar	

Figure 8.14

Delete a Lambda function

When you no longer need the lambda function, you can delete your lambda function in the *AWS Lambda Functions* page.

Select the function you want to delete by clicking on the small circle next to its name; in this tutorial, it is "lambda_test" Figure 8.15).

estFunction2		Throttle Qualifiers	Actions V Select a test event	Test Sav
Configuration Monitoring				
7 Designer				
P				
	TestFunction2			
	Layers	(0))	
+ Add trigger		Amazon Cloud	Watch Logs	
		Resources that the funct	ion's role has access to appear here	
unction code Info				
			Handler Infe	
Tode entry type	Runtime		Hallulet Into	

Figure 8.15

2. Select **Delete** from the **Actions** dropdown menu in Figure 8.15 to delete it.

A confirmation prompt is displayed to make sure the you want to delete the lambda function. Click delete. Successful deletion will be notified in the console (Figure 8.16).

⊘ Your Lambda function "lambda_test" was successfully deleted.	×
Figure 8.16	

Note: The associated role(s) will not be deleted automatically. You have to delete the role(s) manually in Identity and Access management (IAM). Search with the role name and click delete from the menu.