



Masterclass

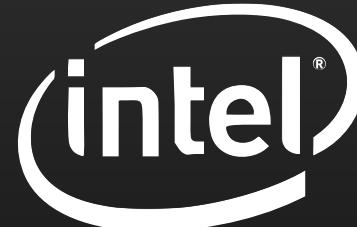
Amazon EC2



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Masterclass

- 1 A technical deep dive that goes beyond the basics
- 2 Intended to educate you on how to get the best from AWS services
- 3 Show you how things work and how to get things done

Amazon EC2



Provides resizable compute capacity in the Cloud
Designed to make web-scale cloud computing easier
A true virtual computing environment
Launch instances with a variety of operating systems
Run as many or few systems as you desire

Completely Controlled

Flexible

Elastic

Web-Scale



Amazon EC2

Easy to Start

Reliable

Inexpensive

Secure



Amazon EC2

Amazon EC2 Beta

by Jeff Barr | on **25 AUG 2006** | in [Announcements](#) | [Permalink](#) | [Comments](#)

Innovation never takes a break, and neither do I. From the steaming hot beaches of Cabo San Lucas I would like to tell you about the Amazon Elastic Compute Cloud, or Amazon EC2, now open for limited beta testing, with more beta slots to open soon.

Amazon EC2 gives you access to a virtual computing environment. Your applications run on a “virtual CPU”, the equivalent of a 1.7 GHz Xeon processor, 1.75 GB of RAM, 160 GB of local disk and 250 Mb/second of network bandwidth. You pay just 10 cents per clock hour (billed to your Amazon Web Services account), and you can get as many virtual CPUs as you need. You can learn more on the [EC2 Detail Page](#). We built Amazon EC2 using a virtual machine monitor by the name of [Xen](#).



	Date	Announcement		
What's New from AWS	>			
Compute	>	Jan 19	Auto Scaling and Elastic Load Balancing support in ClassicLink	
Storage & Content Delivery	>	Jan 14	AWS Lambda Preview now open to all AWS Customers	
Databases	>	Jan 12	Amazon EC2 Auto Recovery now available in the US East (N. Virginia) Region	
Networking	>	Jan 11	Now available: C4 instances, featuring the highest compute performance on Amazon EC2	Blog
Administration & Security	>			
Analytics	>	Jan 8	Amazon VPC ClassicLink is Now Available	Blog
Application Services	>	Jan 5	Announcing Amazon EC2 Spot Instance Termination Notices	
Deployment & Management	>			
Mobile	>	Dec 18	Easily Get Started with Auto Scaling from the AWS Management Console	
Enterprise Applications	>	Dec 15	VM Import for Amazon EC2 is now available in the AWS GovCloud (US) region	
AWS Marketplace & Partners	>			
Government & Public Sector	>	Dec 9	Update to AWS Management Pack for Microsoft System Center Operations Manager 2007 Now Available	
Start-Ups	>	Dec 2	Amazon EC2: Announcing New and Simplified Reserved Instance Payment Options	Blog
Pricing	>	Nov 19	AWS IP Ranges Are Now Available in JSON Format	Blog
Global Infrastructure	>	Nov 13	Introducing Amazon EC2 Container Service	Blog
Training & Certification	>	Nov 13	Introducing AWS Lambda	Blog
Support	>			

Agenda



Amazon EC2 Concepts & Fundamentals
Storage & Networking
Monitoring, Metrics & Logs
Security & Access Control
Deployment
Cost Optimisation

AMAZON EC2 CONCEPTS

REGIONS



The geographical region where Amazon EC2 will launch the instances that you create

Choose a region to optimise latency, minimise costs, or address regulatory requirements

11 regions around the world

AVAILABILITY ZONES



Distinct locations that are engineered to be insulated from failures in other Availability Zones

Provide inexpensive, low latency network connectivity to other Availability Zones in the same Region

Regions contain between 2 & 5 EC2 availability zones

INSTANCES

c4.2xlarge

r3.4xlarge

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

Available in
different locations

Extensive list of
supported operating
systems & software

Integrated with
other AWS Services

AMAZON EC2 FUNDAMENTALS

Choice of instance
families with differing
resource ratios

Import and export
virtual machines

Purchasing options
for cost optimization

Available in
Different Locations



Regions

Each Amazon EC2 region is designed to be completely isolated from the other Amazon EC2 regions. This achieves the greatest possible fault tolerance and stability.

Amazon EC2 provides multiple regions so that you can launch Amazon EC2 instances in locations that meet your requirements. For example, you might want to launch instances in Europe to be closer to your European customers or to meet legal requirements. The following table lists the regions that provide support for Amazon EC2.

Code	Name
ap-northeast-1	Asia Pacific (Tokyo)
ap-southeast-1	Asia Pacific (Singapore)
ap-southeast-2	Asia Pacific (Sydney)
eu-central-1	EU (Frankfurt)
eu-west-1	EU (Ireland)
sa-east-1	South America (Sao Paulo)
us-east-1	US East (N. Virginia)
us-west-1	US West (N. California)
us-west-2	US West (Oregon)

eu-west-2	US West (Oregon)
eu-west-3	US West (N. California)
eu-central-2	EU (Paris)
eu-central-3	EU (Milan)

Extensive list of supported operating systems & software



Operating Systems

Amazon Machine Images (AMIs) are preconfigured with an ever-growing list of operating systems. We work with our partners and community to provide you with the most choice possible. You are also empowered to use our bundling tools to upload your own operating systems. The operating systems currently available to use with your Amazon EC2 instances include:

 Amazon Linux Amazon <small>\$0.02 to \$5.67/hr incl EC2 charges + other AWS usage fees</small>	 Windows Server 2012 Microsoft <small>\$0.02 to \$4.72/hr incl EC2 charges + other AWS usage fees</small>	 CentOS 6.5 CentOS <small>\$0.00/hr for software + AWS usage fees</small>	 Debian 7.4 Debian <small>\$0.00/hr for software + AWS usage fees</small>
--	--	--	--

RedHat Linux, Windows Server, SuSE Linux, Ubuntu, Fedora, Debian, Cent OS, Gentoo Linux, Oracle Linux, and FreeBSD

aws.amazon.com/ec2/faqs/

Extensive list of supported operating systems & software



Software

AWS Marketplace features a wide selection of commercial and free software from well-known vendors, designed to run on your EC2 instances. A sample of products are below. To see the full selection, visit [AWS Marketplace](#).

The screenshot shows three software product cards:

- SAP BusinessObjects** by SAP. Price: \$150.00/mo + \$0.50/hr for software + AWS usage fees.
- LAMP Stacks** by LAMP. Price: From \$0.00/hr for software + AWS usage fees.
- Drupal** by Drupal. Price: From \$0.00/hr for software + AWS usage fees.

Below each card are links to view all products in that category:

- [View all Business Intelligence products \(100+\)](#)
- [View all Application Stacks products \(250+\)](#)
- [View all Content Management products \(225+\)](#)

[View all Business Intelligence products](#)

(100+)

View all Application Stacks products

[View all Application Stacks products](#)

(250+)

[View all Content Management products](#)

(225+)

aws.amazon.com/marketplace

Integrated with
other AWS
Services

- ▶ Amazon Elastic Block Store
- ▶ Amazon CloudWatch
- ▶ Amazon Virtual Private Cloud
- ▶ AWS Identity and Access Management



Purchasing options
for cost optimisation

On-Demand Instances

Pay for compute capacity by the hour with no long-term commitments or upfront payments

Reserved Instances

Provide you with a significant discount (up to 75%) compared to On-Demand Instance pricing

Spot Instances

Purchase compute capacity with no upfront commitment and at hourly rates usually lower than the On-Demand rate



Import and export virtual machines

VM Import/Export enables you to easily import virtual machine images from your existing environment to Amazon EC2 instances and export them back to your on-premises environment. This offering allows you to leverage your existing investments in the virtual machines that you have built to meet your IT security, configuration management, and compliance requirements by bringing those virtual machines into Amazon EC2 as ready-to-use instances. You can also export imported instances back to your on-premises virtualization infrastructure, allowing you to deploy workloads across your IT infrastructure.

VM Import/Export is available at no additional charge beyond standard usage charges for Amazon EC2 and Amazon S3.

charges for Amazon EC2 and Amazon S3.

VM Import/Export is available at no additional charges beyond standard usage charges for Amazon EC2 and Amazon S3.

deploy workloads across your IT infrastructure.





Compute

- General Purpose (M4)
- Compute Optimized (C4)
- Memory Optimized (R3)
- GPU Optimized (G2)
- Storage Optimized (D2)
- IO Optimized (I2)

Low cost, burst-able performance (T2)

Choice of instance families with differing resource ratios



Type



i2.xlarge (Storage-Optimized)

Generation



Family



T2 Instances : Low Cost EC2 Instances with Burstable Performance

AWS Official Blog

New Low Cost EC2 Instances with Burstable Performance

by Jeff Barr | on 01 JUL 2014 | in [Amazon EC2](#) | Permalink | [Comments](#)

Even though the speedometer in my car maxes out at 150 MPH, I rarely drive at that speed (and the top end may be more optimistic than realistic), but it is certainly nice to have the option to do so when the time and the circumstances are right. Most of the time I am using just a fraction of the power that is available to me.

Many interesting compute workloads follow a similar pattern, with modest demands for continuous compute power and occasional needs for a lot more. Examples of this type of workload include remote desktops, development environments (including build servers), low traffic web sites, and small databases. In many of these cases, long periods of low CPU utilization are punctuated by bursts of full-throttle, pedal to the floor processing that can consume an entire CPU core. Many of these workloads are cost-sensitive as well. Organizations often deploy hundreds or thousands of remote desktops and build environments at a time; saving some money on each deployment can have a significant difference in the overall cost. For low traffic web sites and experiments, the ability to be lean-and-mean can have a profound effect on the overall economic model and potential profitability.

New T2 Instances

Today we are launching new T2 instances for [Amazon EC2](#). The T2 instances will dramatically reduce costs for applications that can benefit from bursts of CPU power. The instances are available in three sizes (micro, small, and medium) with On-Demand prices that start at \$0.013 per hour (\$9.50 per month). You can also gain access to a pair of t2.micro instances (one running Linux and another running Windows) at no charge via the [AWS Free Usage Tier](#).

The T2 instances are built around a processing allocation model that provides you a generous, assured baseline amount of processing power coupled with the ability to automatically and transparently scale up to a full core when you need more compute power. Your ability to burst is based on the concept of "CPU Credits" that you accumulate during quiet periods and spend when things get busy. You can provision an instance of modest size and cost and still have more than adequate compute power in reserve to handle peak demands for compute power.

Read more

AWS Official Blog

New T2.Large Instances

by Jeff Barr | on 17 JUN 2015 | in [Amazon EC2](#) | Permalink

We launched the T2 instances last summer (see my post, [New Low Cost EC2 Instances with Burstable Performance](#) for more information). These instances give you a generous amount of baseline capacity and the ability to automatically and transparently scale up to full-core processing power on an as-needed basis. The bursting model is based on "CPU Credits" that accumulate during quiet periods for spending when things get busy.

Today we are adding the t2.large instance based on customer feedback and on our own usage data. Our customers told us that the burst-based model gave them plenty of CPU power to run applications that consumed large amounts of memory. The new size provides double the amount of memory, along with a higher baseline level of CPU power.

Many AWS customers are running development environments, small databases, application servers, and web servers on their T2 instances. These applications generally don't need the full CPU very often, but they do need to burst to higher CPU performance from time to time.

Here are the specs for all of the sizes of T2 instances:

Name	vCPUs	Baseline Performance	Platform	RAM (GiB)	CPU Credits / Hour	Price / Hour (Linux)	Price / Month (Linux)
t2.micro	1	10%	32-bit or 64-bit	1	6	\$0.013	\$9.50
t2.small	1	20%	32-bit or 64-bit	2	12	\$0.026	\$19.00
t2.medium	2	40%	32-bit or 64-bit	4	24	\$0.052	\$38.00
t2.large	2	80%	64-bit	8	36	\$0.104	\$76.00

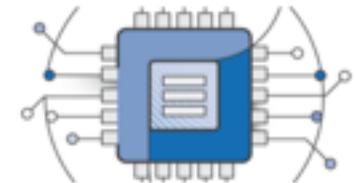
Instance Type	Processor	Memory	Storage	Networking	Compute	Price / Hour (Linux)	Price / Month (Linux)
t2.micro	Intel Xeon E3 v1	1 GiB	Standard	1 Gbps	10%	\$0.013	\$9.50
t2.small	Intel Xeon E3 v1	2 GiB	Standard	1 Gbps	20%	\$0.026	\$19.00
t2.medium	Intel Xeon E3 v1	4 GiB	Standard	1 Gbps	40%	\$0.052	\$38.00
t2.large	Intel Xeon E3 v1	8 GiB	Standard	1 Gbps	80%	\$0.104	\$76.00

C4 Instances : Highest Compute Performance on Amazon EC2

Model	vCPU	Mem (GiB)	Storage
c4.large	2	3.75	EBS-Only
c4.xlarge	4	7.5	EBS-Only
c4.2xlarge	8	15	EBS-Only
c4.4xlarge	16	30	EBS-Only
c4.8xlarge	36	60	EBS-Only
c4.16xlarge	72	90	EBS-Only

The latest processor technology

The latest Intel Xeon processors are utilized, providing customers with high performance and value, and the ability to choose Amazon EC2 instance types that best meet their performance needs for compute intensive, memory intensive, or IOPS intensive applications.



Amazon EC2 C4 instances include Intel's latest 22nm Haswell microarchitecture with custom Intel® Xeon® v3 processors.

Benefits of Xeon® v3 processors include:

- Haswell microarchitecture has better branch prediction; efficient at prefetching instructions and data; along with other improvements that can boost existing applications' performance by 30% or more
- P state and C state control provides the ability to individually tune each cores performance and sleep states to improve application performance
- Intel® AVX2.0 instructions can double the floating-point performance for compute-intensive workloads over Intel® AVX, and provides additional instructions useful for compression and encryption

Several other Amazon EC2 instance types include Advanced Intel features offered on Intel Xeon E5 processors in select Amazon EC2 instance types.

Benefits of Intel Xeon® E5 processors include:

- Intel AES-NI – Intel processors that support Intel Advanced Encryption Standard - New Instructions allow you to enable encryption for enhanced data security without paying a performance penalty.
- Intel AVX – With Intel Advanced Vector Extensions, get dramatically better performance for highly parallel HPC workloads such as life science engineering, data mining, financial analysis, or other technical computing applications. AVX also enhances image, video, and audio processing.
- Intel Turbo Boost Technology – Get a clock rate boost of compute speed, accelerating performance for peak loads. Appropriate for traditional non-parallel workloads.

Launch your instance

Start an EC2 instance
using console, CLI tools
or an AWS SDK

Launch your instance



Configure your instance

Configure your instance
using an AMI or
automation tools

EC2 Instance Metadata

```
$ curl http://169.254.169.254/latest/meta-data/  
  
ami-id  
ami-launch-index  
ami-manifest-path  
block-device-mapping/  
hostname  
instance-action  
instance-id  
instance-type  
kernel-id  
local-hostname  
local-ipv4  
mac  
network/  
placement/  
public-hostname  
public-ipv4  
public-keys/  
reservation-id  
security-groups  
services/  
  
$ curl http://169.254.169.254/latest/user-data  
  
...
```

EC2 User data

AWS provided AMIs include services that access and execute the contents of the User data attribute in EC2 Instance Metadata at instance creation time

This can be used for automated instance bootstrapping at instance creation time

Windows

```
<script>...</script>
```

or

```
<powershell>...</powershell>
```

Linux

```
#!/bin/bash  
yum update -y
```

Launch your instance



Configure your instance



Connect to your instance (optional)

Connect to your
instance using standard
protocols (ssh/RDP)

Launch your instance



Configure your instance



Connect to your instance (optional)



Terminate your instance

Terminate your instance
to minimise costs

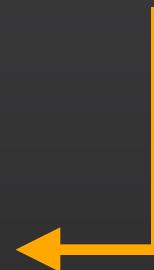
DEMO:

GETTING STARTED WITH EC2

```
aws ec2 run-instances \  
  --image-id ami-a10897d6 \  
  --instance-type t2.micro \  
  --count 1 \  
  --security-group-ids sg-0ba94d6e \  
  --key-name MyKeyPair
```

Amazon Machine Image ID

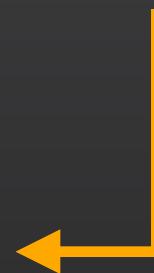
Control via AWS CLI



Control via AWS CLI

```
aws ec2 run-instances \  
  --image-id ami-a10897d6 \  
  --instance-type t2.micro \  
  --count 1 \  
  --security-group-ids sg-0ba94d6e \  
  --key-name MyKeyPair
```

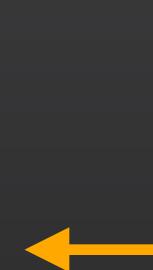
EC2 instance type to run



Control via AWS CLI

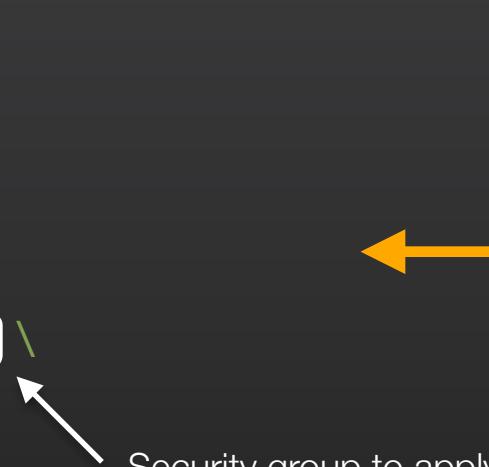
```
aws ec2 run-instances \  
  --image-id ami-a10897d6 \  
  --instance-type t2.micro \  
  --count 1 \  
  --security-group-ids sg-0ba94d6e \  
  --key-name MyKeyPair
```

Number of instances to run



```
aws ec2 run-instances \  
  --image-id ami-a10897d6 \  
  --instance-type t2.micro \  
  --count 1 \  
  --security-group-ids sg-0ba94d6e \  
  --key-name MyKeyPair
```

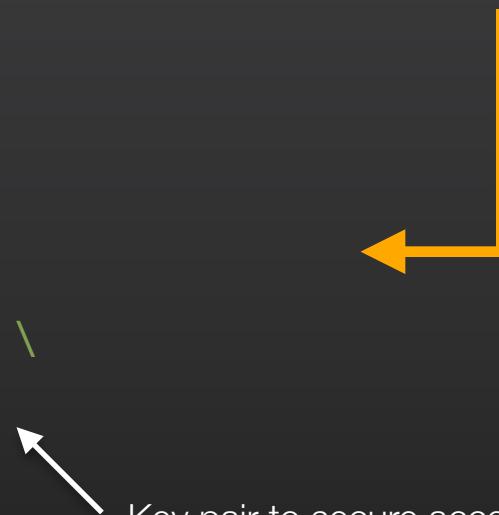
Control via AWS CLI



Security group to apply to instance(s)

```
aws ec2 run-instances \  
  --image-id ami-a10897d6 \  
  --instance-type t2.micro \  
  --count 1 \  
  --security-group-ids sg-0ba94d6e \  
  --key-name MyKeyPair
```

Control via AWS CLI



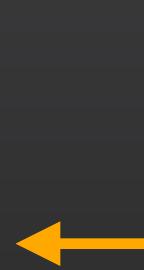
Key pair to secure access to instance(s)

AWS CLI

```
$ aws ec2 run-instances --image-id ami-018897d6 --instance-type t2.micro --count 1 --security-group-ids sg-0bd94d6e --key-name ManagementKeyPair --output table
```

RunInstances	
OwnerId	554625704737
ReservationId	r-b2833855
Instances	
AmiLaunchIndex	0
Architecture	x86_64
ClientToken	
EbsOptimized	False
Hypervisor	xen
ImageId	ami-018897d6
InstanceId	i-f6c0dd5c
InstanceType	t2.micro
KeyName	ManagementKeyPair
LaunchTime	2015-07-17T12:36:47.000Z
PrivateDnsName	ip-172-31-48-92.eu-west-1.compute.internal
PrivateIpAddress	172.31.48.92
PublicDnsName	
RootDeviceName	/dev/xvda
RootDeviceType	ebs
SourceDestCheck	True
StateTransitionReason	
SubnetId	subnet-7cdbf188
VirtualizationType	hvm
VpcId	vpc-b7b8b3d5
Monitoring	
State	disabled
NetworkInterfaces	
Description	
MacAddress	06:85:c0:e8:0b:ed
NetworkInterfaceId	eni-29a95360
PrivateDnsName	eni-5a0a2300
PrivateIpAddress	06:82:c0:e0:0d:69
SubnetId	

Control via AWS CLI



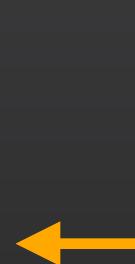
Detailed help on a specific command

In this case:

```
aws ec2 run-instances
```

NAME	RUN-INSTANCES()
run-instances -	RUN-INSTANCES()
DESCRIPTION	<p>Launches the specified number of instances using an AMI for which you have permissions.</p> <p>When you launch an instance, it enters the pending state. After the instance is ready for you, it enters the running state. To check the state of your instance, call <code>describe-instances</code>.</p> <p>If you don't specify a security group when launching an instance, Amazon EC2 uses the default security group. For more information, see Security Groups in the Amazon Elastic Compute Cloud User Guide.</p> <p>Linux instances have access to the public key of the key pair at boot. You can use this key to provide secure access to the instance. Amazon EC2 public images use this feature to provide secure access without passwords. For more information, see Key Pairs in the Amazon Elastic Compute Cloud User Guide.</p> <p>You can provide optional user data when launching an instance. For more information, see Instance Metadata in the Amazon Elastic Compute Cloud User Guide.</p> <p>If any of the AMIs have a product code attached for which the user has not subscribed, <code>run-instances</code> fails.</p> <p>T2 instance types can only be launched into a VPC. If you do not have a default VPC, or if you do not specify a subnet ID in the request, <code>run-instances</code> fails.</p>

Control via AWS CLI



Detailed help on a specific command

In this case:

```
aws ec2 run-instances
```

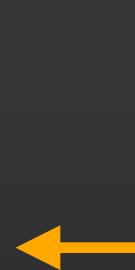
```
SYNOPSIS
    run-instances
        [--dry-run | --no-dry-run]
        --image-id <value>
        [--key-name <value>]
        [--security-groups <value>]
        [--security-group-ids <value>]
        [--user-data <value>]
        [--instance-type <value>]
        [--placement <value>]
        [--kernel-id <value>]
        [--ramdisk-id <value>]
        [--block-device-mappings <value>]
        [--monitoring <value>]
        [--subnet-id <value>]
        [--disable-api-termination | --enable-api-termination]
        [--instance-initiated-shutdown-behavior <value>]
        [--private-ip-address <value>]
        [--client-token <value>]
        [--additional-info <value>]
        [--network-interfaces <value>]
        [--iam-instance-profile <value>]
        [--ebs-optimized | --no-ebs-optimized]
        [--count <value>]
        [--secondary-private-ip-addresses <value>]
        [--secondary-private-ip-address-count <value>]
        [--associate-public-ip-address | --no-associate-public-ip-address]
        [--cli-input-json <value>]
        [--generate-cli-skeleton]
```

OPTIONS

```
--dry-run | --no-dry-run (boolean)
    Checks whether you have the required permissions for the action,
    without actually making the request, and provides an error response.
    If you have the required permissions, the error response is DryRun.
```

It looks like the required permissions, the error response is DryRun without actually making the request, and provides an error response. Checks whether you have the required permissions for the action.

Control via AWS CLI



Launching and Terminating Instances

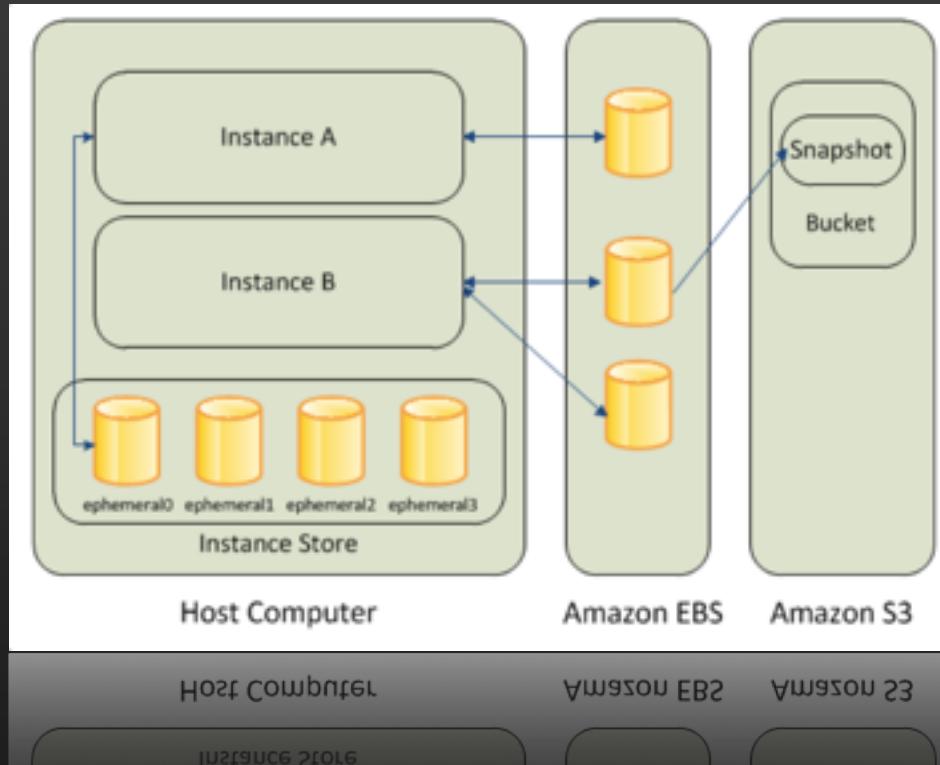
Python Boto3

```
>>> import boto3
>>> ec2 = boto3.resource('ec2')
>>> ec2.create_instances(ImageId='ami-a10897d6', MinCount=1,
MaxCount=1, InstanceType='t2.micro', KeyName='ManagementKeyPair',
SecurityGroupIds=['sg-0ba94d6e'])

[ec2.Instance(id='i-a459450e')]
>>> ec2.instances.filter(InstanceIds=['i-a459450e']).terminate()
[{u'TerminatingInstances': [{u'InstanceId': 'i-a459450e',
u'CurrentState': {u'Code': 32, u'Name': 'shutting-down'},
u'PreviousState': {u'Code': 0, u'Name': 'pending'}}],
'ResponseMetadata': {'HTTPStatusCode': 200, 'RequestId': 'f3956d8f-
ce21-47f2-88fc-ac53cde3137f'}}]
>>>
```

STORAGE

Data Storage Options



Instance Store

Physically attached
to the host computer

Type and amount differs
by instance type

Data **dependent** upon
instance lifecycle

Amazon EBS

Persistent block level
storage volumes

Magnetic
General Purpose (SSD)
Provisioned IOPS (SSD)

Data **independent** of
instance lifecycle

Instance Store

Physically attached
to the host computer

Type and amount differs
by instance type

Data **dependent** upon
instance lifecycle

Instance store data **persists** if:

- The OS in the instance is rebooted
- The instance is restarted

Instance store data is **lost** when:

- An underlying instance drive fails
- An EBS-backed instance is stopped
- The instance is terminated

EBS Volumes

EBS volumes automatically **replicated** within the **Availability Zone (AZ)** in which are created

Use EBS-optimized instances to deliver **dedicated throughput** between Amazon EC2 and Amazon EBS, with options between 500 and 4,000 Mbps, depending on the instance type

Amazon EBS

Persistent block level storage volumes

Magnetic
General Purpose (SSD)
Provisioned IOPS (SSD)

Data **independent** of instance lifecycle

EBS Volumes

EBS volumes **attached** to a running instance automatically detach from the instance with their data intact when that instance is terminated.

EBS volumes created and attached to an instance at **launch** are deleted when that instance is terminated. You can modify this behavior by changing the value of the flag **DeleteOnTermination**.

Amazon EBS

Persistent block level storage volumes

Magnetic
General Purpose (SSD)
Provisioned IOPS (SSD)

Data **independent** of instance lifecycle

Amazon EBS

EBS Snapshots

An EBS snapshot is a **point-in-time backup copy** of an EBS volume that is stored in Amazon S3

Snapshots are **incremental**, only the blocks that have changed after your most recent snapshot are saved

Persistent block level storage volumes

Magnetic
General Purpose (SSD)
Provisioned IOPS (SSD)

Data **independent** of instance lifecycle

Amazon EBS

EBS Snapshots

When you delete a snapshot, only the data **exclusive** to that snapshot is removed

Can be **shared** across AWS accounts or **copied** across AWS regions

Persistent block level storage volumes

Magnetic
General Purpose (SSD)
Provisioned IOPS (SSD)

Data **independent** of instance lifecycle

Amazon EBS

EBS Encryption

Data stored at rest on the volume, disk I/O, and snapshots created from the volume are **all** encrypted

The encryption occurs on the servers that **host** Amazon EC2 instances, providing encryption of **data-in-transit** from EC2 instances to EBS storage

Persistent block level storage volumes

Magnetic
General Purpose (SSD)
Provisioned IOPS (SSD)

Data **independent** of instance lifecycle

EBS Encryption

Uses **AWS Key Management Service** (AWS KMS) master keys unless you select a **Customer Master Key** (CMK).

Creating **your own CMK** gives you the ability to create, rotate, disable, define access controls, and audit the encryption keys.

Amazon EBS

Persistent block level storage volumes

Magnetic
General Purpose (SSD)
Provisioned IOPS (SSD)

Data **independent** of instance lifecycle

New EBS Volumes: Larger & Faster

General Purpose (SSD)

Up to 16TB
10,000 IOPS (burst)
Up to 160 MBps

Provisioned IOPS (SSD)

Up to 16TB
20,000 IOPS
Up to 320 MBps

DEMO:

EC2 STORAGE

NETWORKING

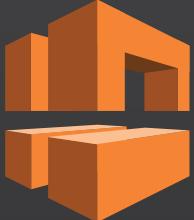


Virtual Private Cloud



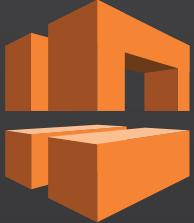
Amazon VPC

A virtual network in your own **logically isolated area** within the AWS cloud populated by infrastructure, platform, and application services that share common **security** and **interconnection**



VPC Networking

- ▶ Elastic Network Interface (ENI)
- ▶ Subnet
- ▶ Network Access Control List (NACL)
- ▶ Route Table
- ▶ Internet Gateway
- ▶ Virtual Private Gateway
- ▶ Route 53 Private Hosted Zone



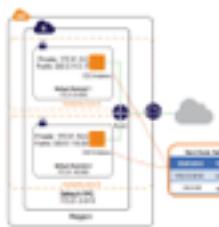
VPC Network Topology

A VPC can span multiple AZs, but each subnet must reside entirely within one AZ

Use at least 2 subnets in different AZs for each layer of your network



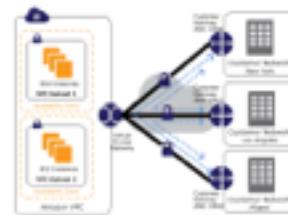
Control of subnets and routing tables



Sample VPC
with
2 Public Subnets



Sample VPC
with
1 Public Subnet,
2 Private Subnets,
1 of which
can route
through the VPN



Sample
VPN
CloudHub



VPC Creation with the VPC Wizard

Step 1: Select a VPC Configuration

VPC with a Single Public Subnet

VPC with Public and Private Subnets

VPC with Public and Private Subnets and Hardware VPN Access

VPC with a Private Subnet Only and Hardware VPN Access

Your instances run in a private, isolated section of the AWS cloud with direct access to the Internet. Network access control lists and security groups can be used to provide strict control over inbound and outbound network traffic to your instances.

Creates:

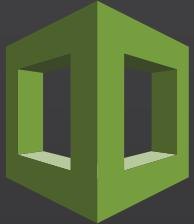
A /16 network with a /24 subnet. Public subnet instances use Elastic IPs or Public IPs to access the Internet.

Select



[Cancel and Exit](#)

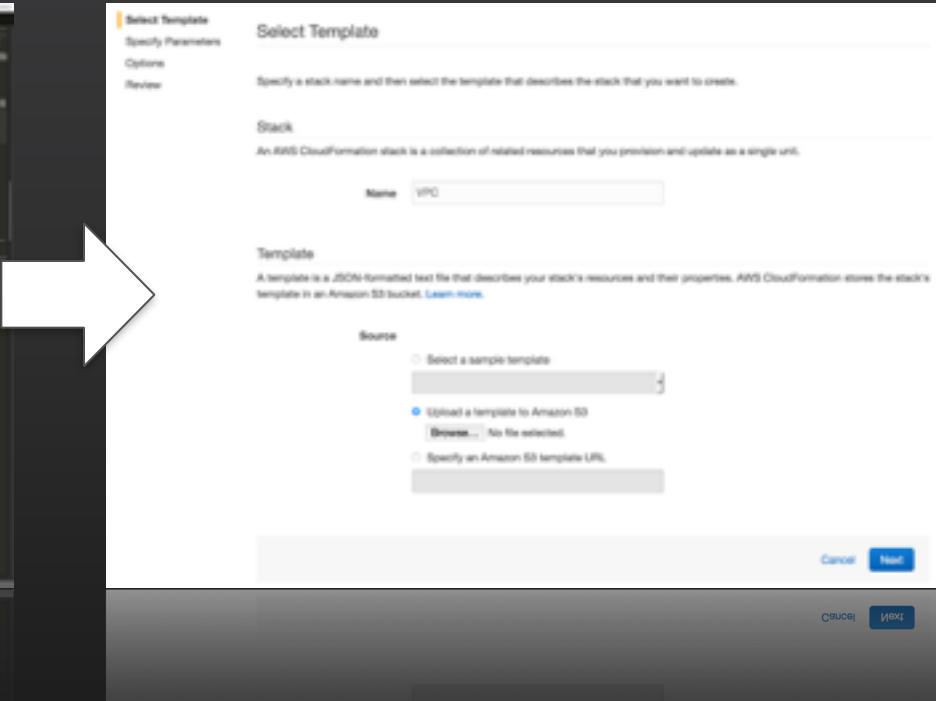
[Edit this landing](#)



VPC Creation with AWS CloudFormation

```

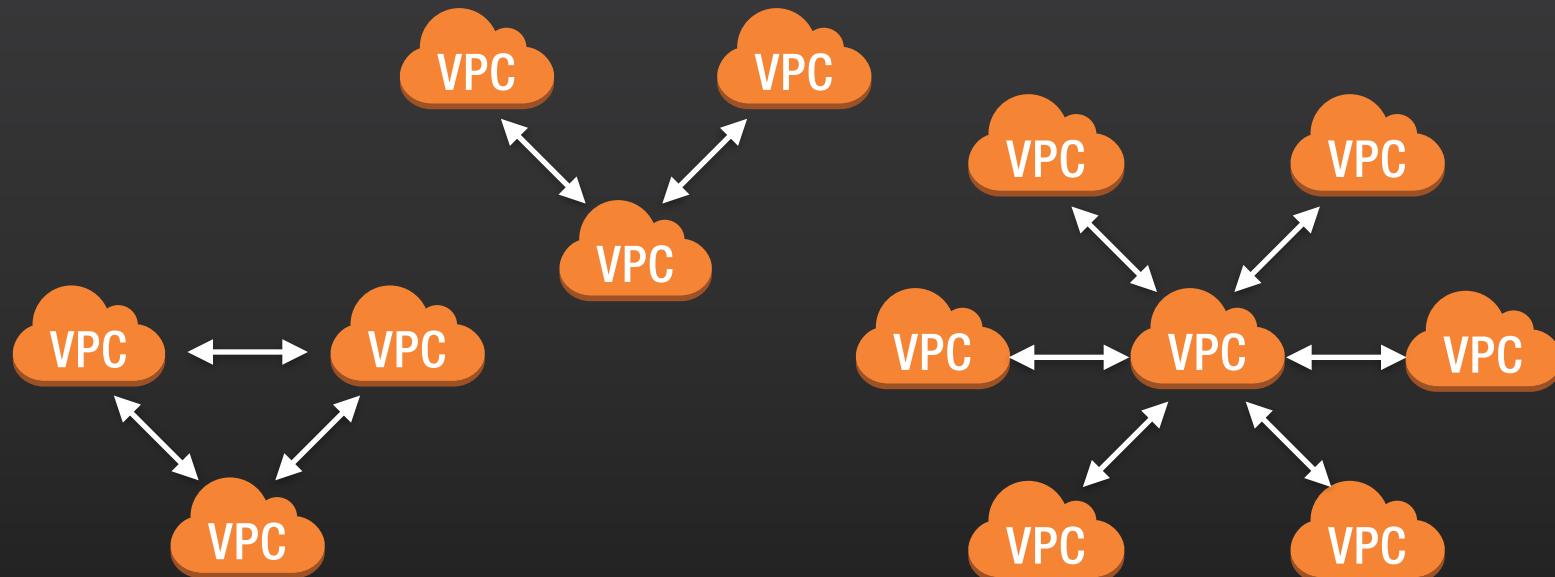
111 "Resources": {
112   "myEC2": {
113     "Type": "AWS::EC2::VPC",
114     "Properties": {
115       "CidrBlock": "10.0.0.0/16",
116       "Tags": [
117         {
118           "Key": "Application",
119           "Value": {
120             "Ref": "stackId"
121           }
122         }
123       ]
124     }
125   },
126   "subnet1": {
127     "Type": "AWS::EC2::Subnet",
128     "Properties": {
129       "CidrBlock": "10.0.1.0/24",
130       "EnableDnsSupport": true,
131       "Tags": [
132         {
133           "Key": "Application",
134           "Value": {
135             "Ref": "stackId"
136           }
137         }
138       ]
139     }
140   },
141   "internetGateway": {
142     "Type": "AWS::EC2::InternetGateway",
143     "Properties": {
144       "Tags": [
145         {
146           "Key": "Application",
147           "Value": {
148             "Ref": "stackId"
149           }
150         }
151       ]
152     }
153   },
154   "attachment": {
155     "Type": "AWS::EC2::VPCAttachment",
156     "Properties": {
157       "VpcId": {
158         "Ref": "myEC2"
159       },
160       "InternetGatewayId": {
161         "Ref": "internetGateway"
162       }
163     }
164   },
165   "routeTable": {
166     "Type": "AWS::EC2::RouteTable",
167     "Properties": {
168       "VpcId": {
169         "Ref": "myEC2"
170       },
171       "Tags": [
172         {
173           "Key": "Application",
174           "Value": {
175             "Ref": "stackId"
176           }
177         }
178       ]
179     }
180   },
181   "route": {
182     "Type": "AWS::EC2::Route",
183     "Properties": {
184       "DestinationCidrBlock": "0.0.0.0/0",
185       "RouteTableId": {
186         "Ref": "routeTable"
187       },
188       "InterfaceName": "eni-0000-0000-0000-0000",
189       "NatGatewayId": {
190         "Ref": "natGw"
191       }
192     }
193   }
194 }
195 
```





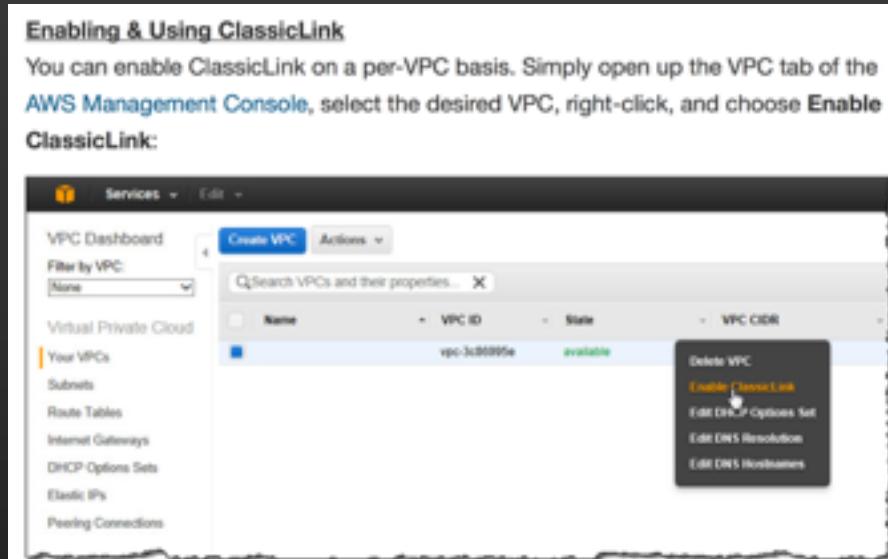
VPC Peering

A networking connection between two VPCs



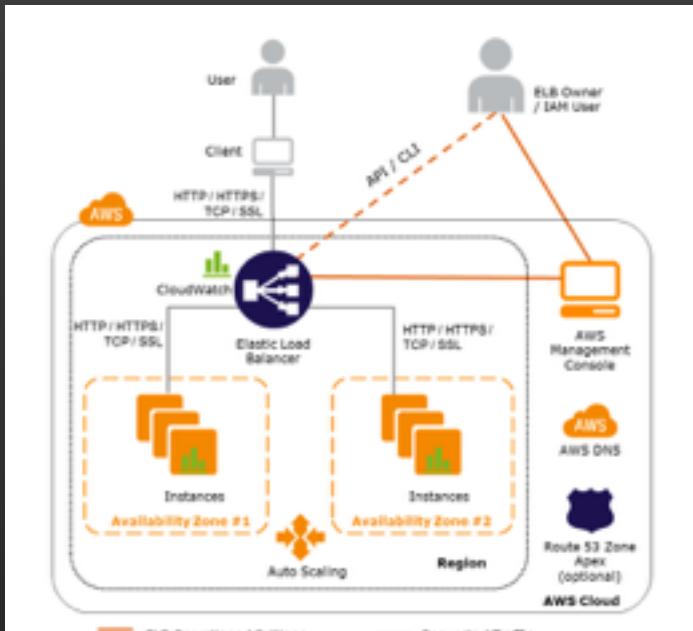
ClassicLink

Private Communication Between Classic EC2 Instances & VPC Resources





Elastic Load-Balancing

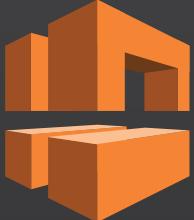


- ▶ Timeout Configuration
- ▶ Connection Draining
- ▶ Cross-zone Load Balancing

DEMO:

CREATING AN ELB

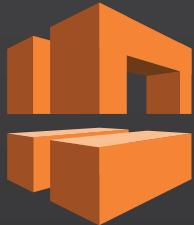
MONITORING, METRICS & LOGS



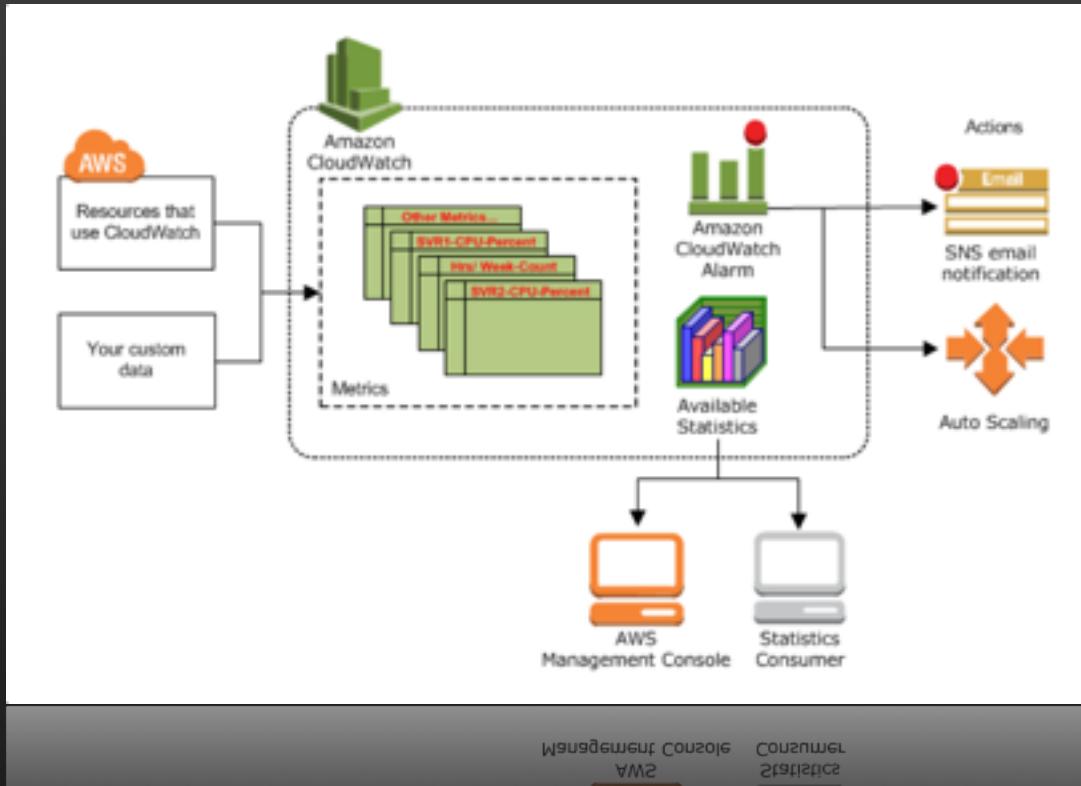
Amazon CloudWatch

A monitoring service for AWS cloud resources and the applications you run on AWS.

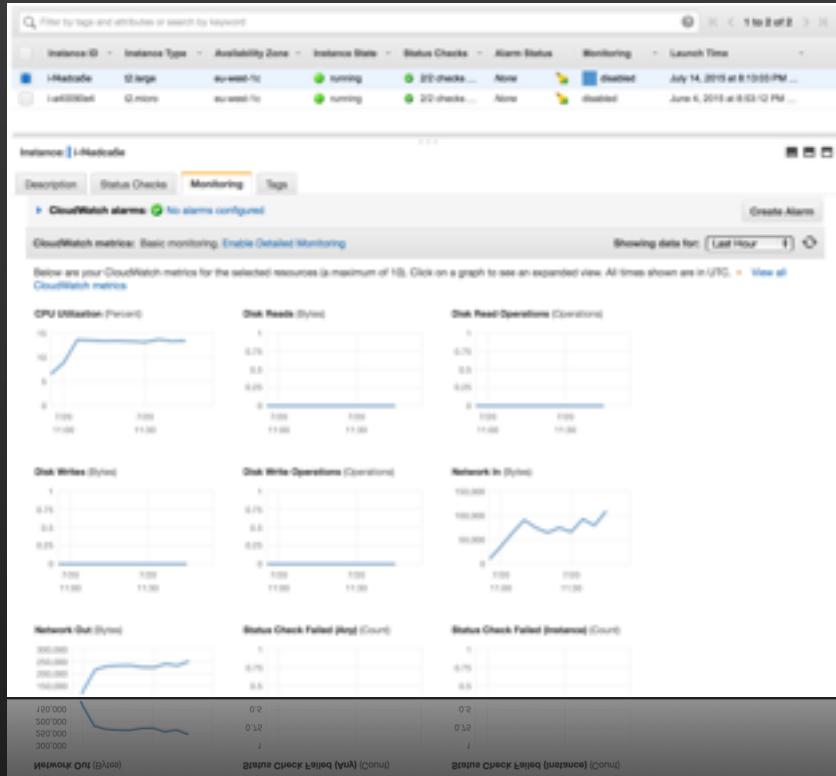
Use Amazon CloudWatch to collect and track metrics, collect and monitor log files, and set alarms.



Amazon CloudWatch



CloudWatch Metrics in the EC2 Console



Monitoring Scripts for EC2 Instances

Monitoring Scripts for Amazon EC2 Instances

The Amazon CloudWatch Monitoring Scripts for Amazon Elastic Compute Cloud (Amazon EC2) Linux- and Windows-based instances demonstrate how to produce and consume Amazon CloudWatch custom metrics. These sample Perl scripts comprise a fully functional example that reports memory, swap, and disk space utilization metrics for a Linux instance. The scripts for Windows are sample PowerShell scripts that comprise a fully functional example that reports memory, page file, and disk space utilization metrics for a Windows instance. You can download the CloudWatch Monitoring Scripts for Linux and for Windows from the Amazon Web Services (AWS) sample code library and install them on your Linux- or Windows-based instances.

Important

These scripts are examples only. They are provided "as is" and are not supported.

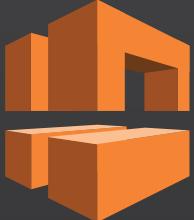
Note

Standard Amazon CloudWatch free tier quantities and usage charges for custom metrics apply to your use of these scripts. For more information, see the [Amazon CloudWatch](#) pricing page.

Topics

- [Amazon CloudWatch Monitoring Scripts for Linux](#)
- [Amazon CloudWatch Monitoring Scripts for Windows](#)

- [Amazon CloudWatch Metrics Overview](#)
- [Amazon CloudWatch Metrics Data Types](#)



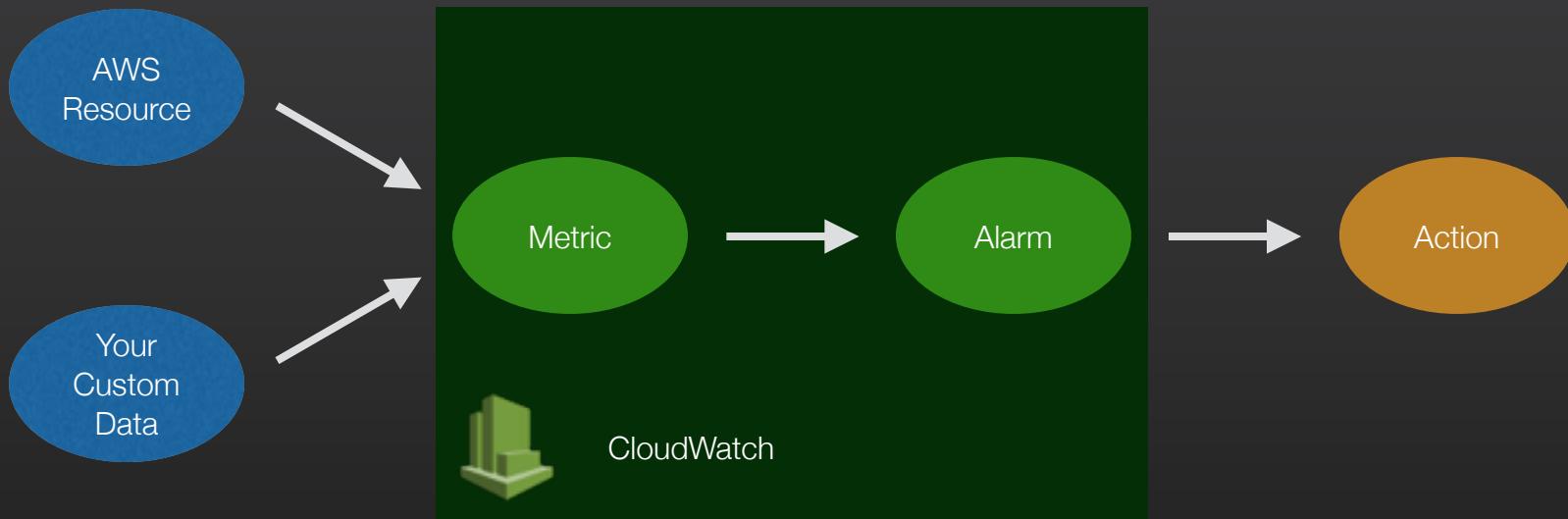
Amazon CloudWatch Logs

Monitor applications and systems using log data
Store in a highly durable storage and set retention
Access your log files via Web, CLI or SDK

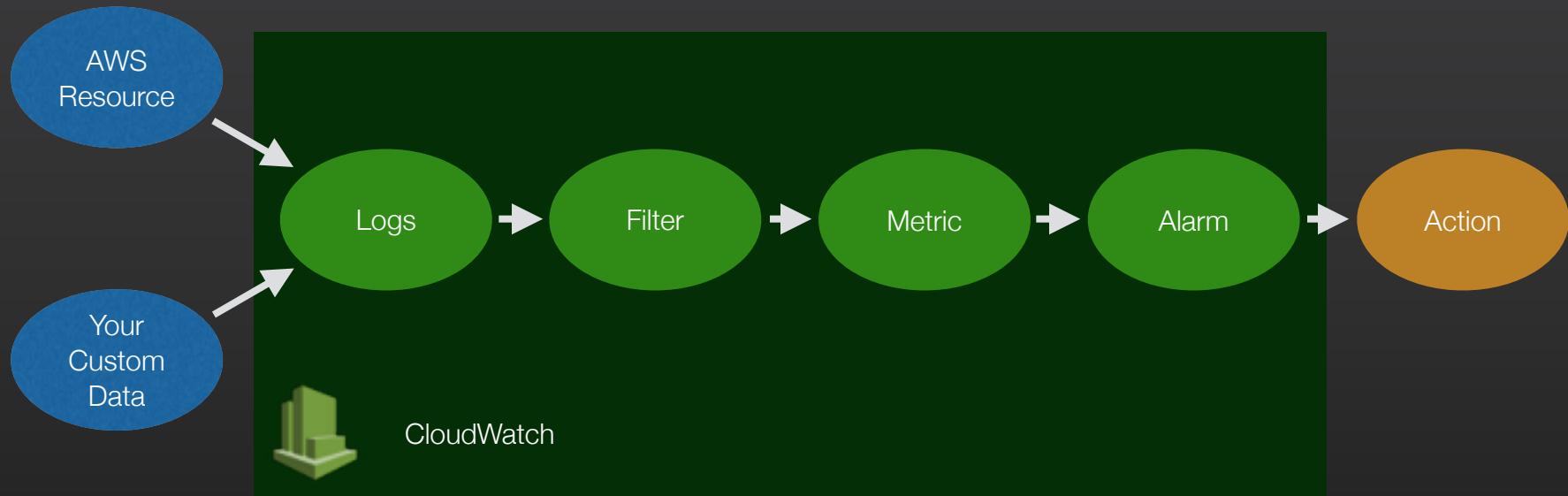
Amazon EC2 (Linux & Windows)
AWS Lambda

...

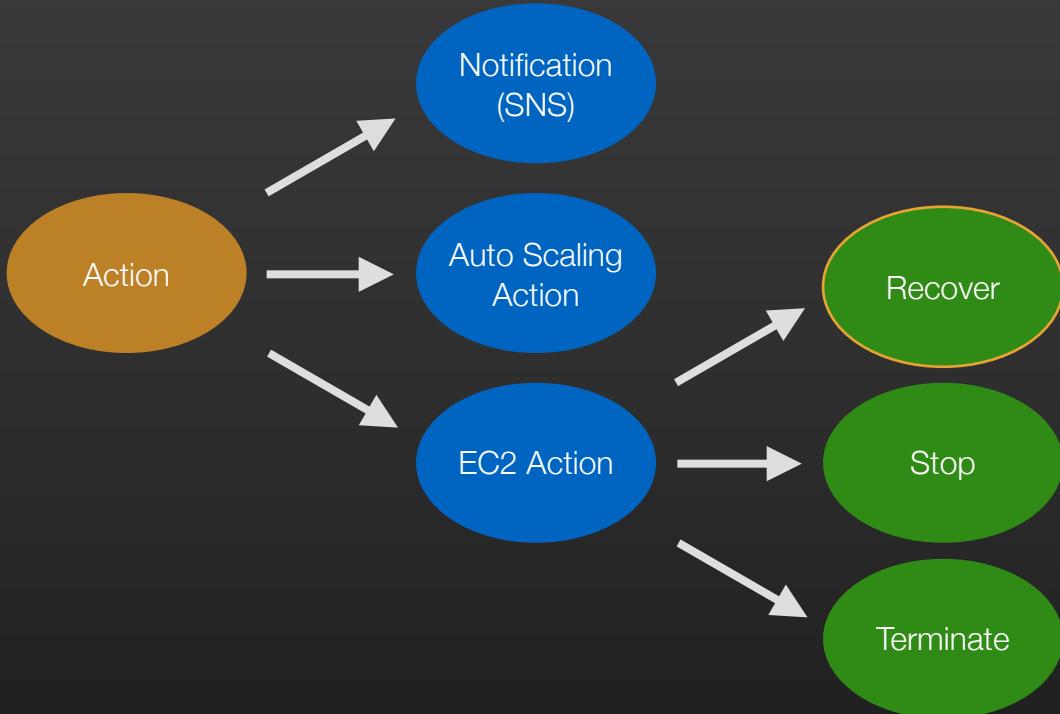
CloudWatch Metrics & Alarms



CloudWatch Logs + Filter



Alarm Actions



Amazon EC2
Auto Recovery

Use this action
together with
Status Checks
to automate
instance recovery

SECURITY & ACCESS CONTROL

Access Credentials

Access key and secret key used to authenticate when accessing AWS APIs

Key Pairs

Public key and private key used to authenticate when accessing an Amazon EC2 instance

**USE IAM ROLES TO PASS ACCESS
CREDENTIALS TO AN INSTANCE**

DEMO:

USING IAM ROLES

DEPLOYMENT

**“IF YOU NEED TO SSH INTO YOUR
INSTANCE, YOUR DEPLOYMENT
PROCESS IS BROKEN.”**

AMAZON MACHINE IMAGES

Amazon maintained

Set of Linux and Windows images
Kept up to date by Amazon in each region

Community maintained

Images published by other AWS users
Managed and maintained by Marketplace partners

Your machine images

AMIs you have created from EC2 instances
Can be kept private or shared with other accounts

Bake an AMI

Start an instance

Configure the instance

Create an AMI from your instance

Start new ones from the AMI

Bake an AMI

- Start an instance
- Configure the instance
- Create an AMI from your instance
- Start new ones from the AMI

Configure dynamically

- Launch an instance
- Use metadata service and cloud-init to perform actions on instance when it launches

Bake an AMI

Build your base images and
setup custom initialisation
scripts

Maintain your ‘golden’ base



Configure dynamically

Use bootstrapping to pass
custom information in and
perform post launch tasks like
pulling code from SVN

Bake an
AMI

Configure
dynamically



Time consuming configuration
startup time

Static configurations
less change management

Bake an
AMI

Configure
dynamically



Continuous deployment
latest code

Environment specific
dev-test-prod

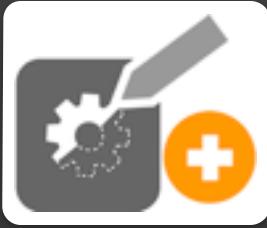
AUTO SCALING

Maintain EC2 instance availability

Detects impaired EC2 instances
Replaces the instances automatically

Automatically Scale Your Amazon EC2 Fleet

Follow the demand curve for your applications
Reduce the need to manually provision Amazon EC2 capacity
Run at optimal utilisation



Reusable Instance Templates

Provision instances based on a reusable template you define, called a launch configuration.



Automated Provisioning

Keep your Auto Scaling group healthy and balanced, whether you need one instance or 1,000.



Adjustable Capacity

Maintain a fixed group size or adjust dynamically based on Amazon CloudWatch metrics.

Launch Configuration

Describes what Auto Scaling will create when adding Instances

Only one active launch configuration at a time

```
aws autoscaling create-launch-configuration  
  --launch-configuration-name launch-config  
  --image-id ami-54cf5c3d  
  --instance-type m3.medium  
  --key-name mykey  
  --security-groups webservers
```

Auto Scaling Group

Auto Scaling managed grouping of EC2 instances

Automatically scale the number of instances by policy

```
aws autoscaling create-auto-scaling-group  
  --auto-scaling-group-name autoscaling-group  
  --availability-zones eu-west-1a eu-west-1b  
  --launch-configuration launch-config  
  --load-balancer-names myELB  
  --min-size 1  
  --max-size 5
```

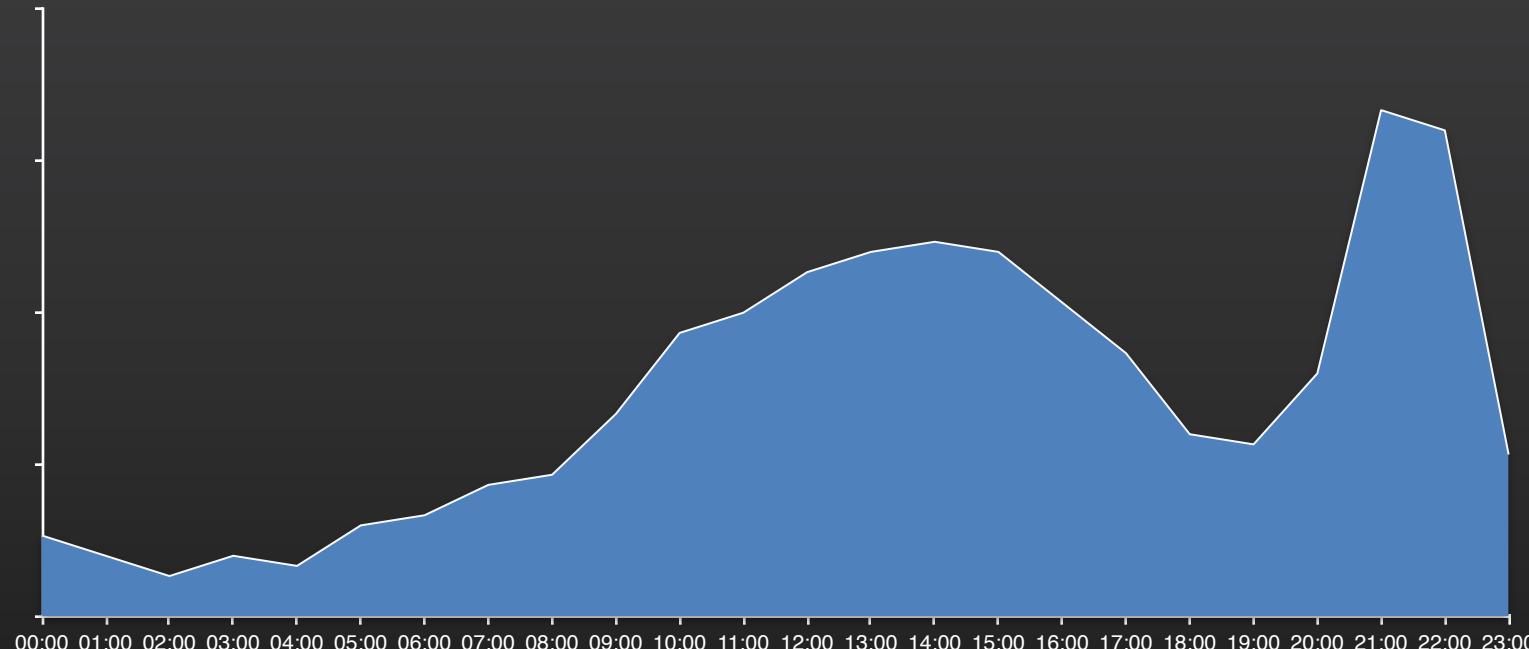
Auto Scaling Policy

Parameters for performing an Auto Scaling action

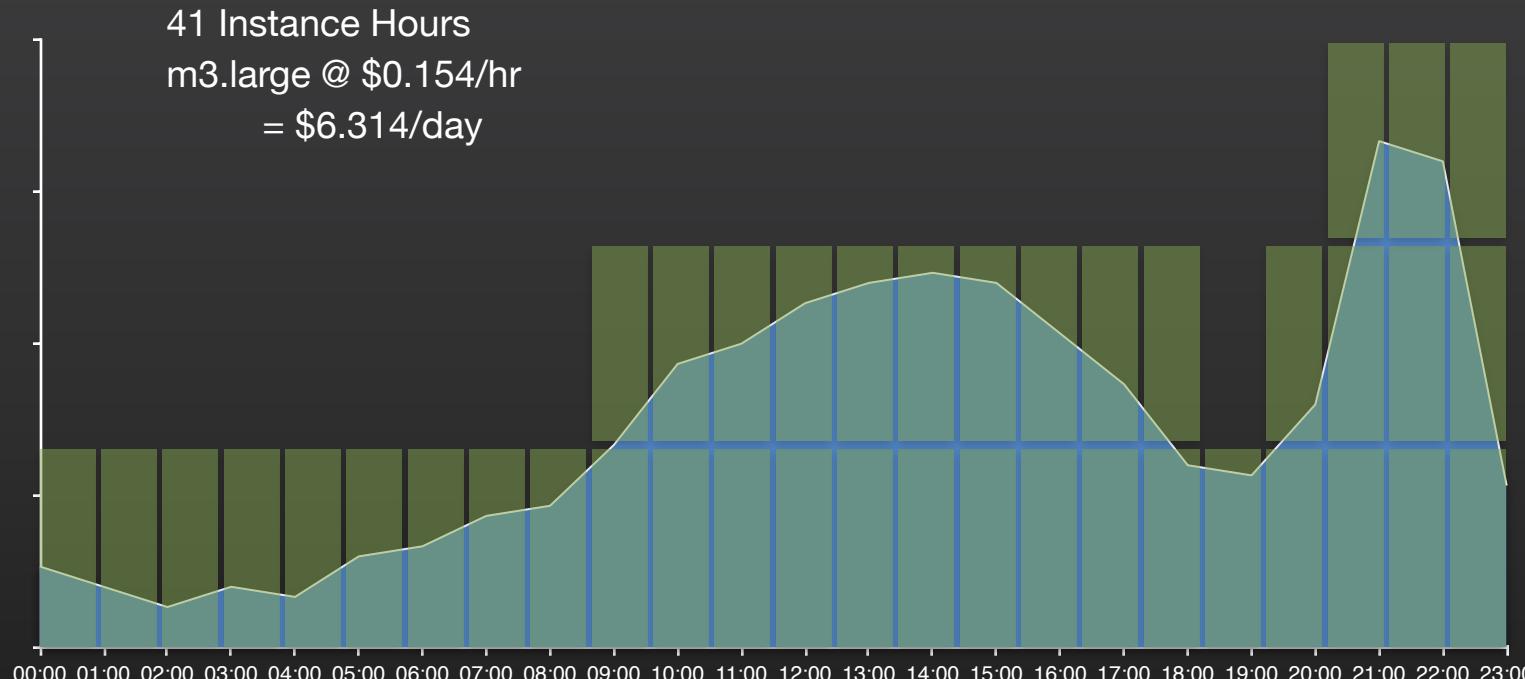
Scale Up/Down and by how much

```
aws autoscaling put-scaling-policy  
  --auto-scaling-group-name autoscaling-group  
  --policy-name autoscaling-policy  
  --min-adjustment-magnitude=2  
  --adjustment-type ChangeInCapacity  
  --cooldown 300
```

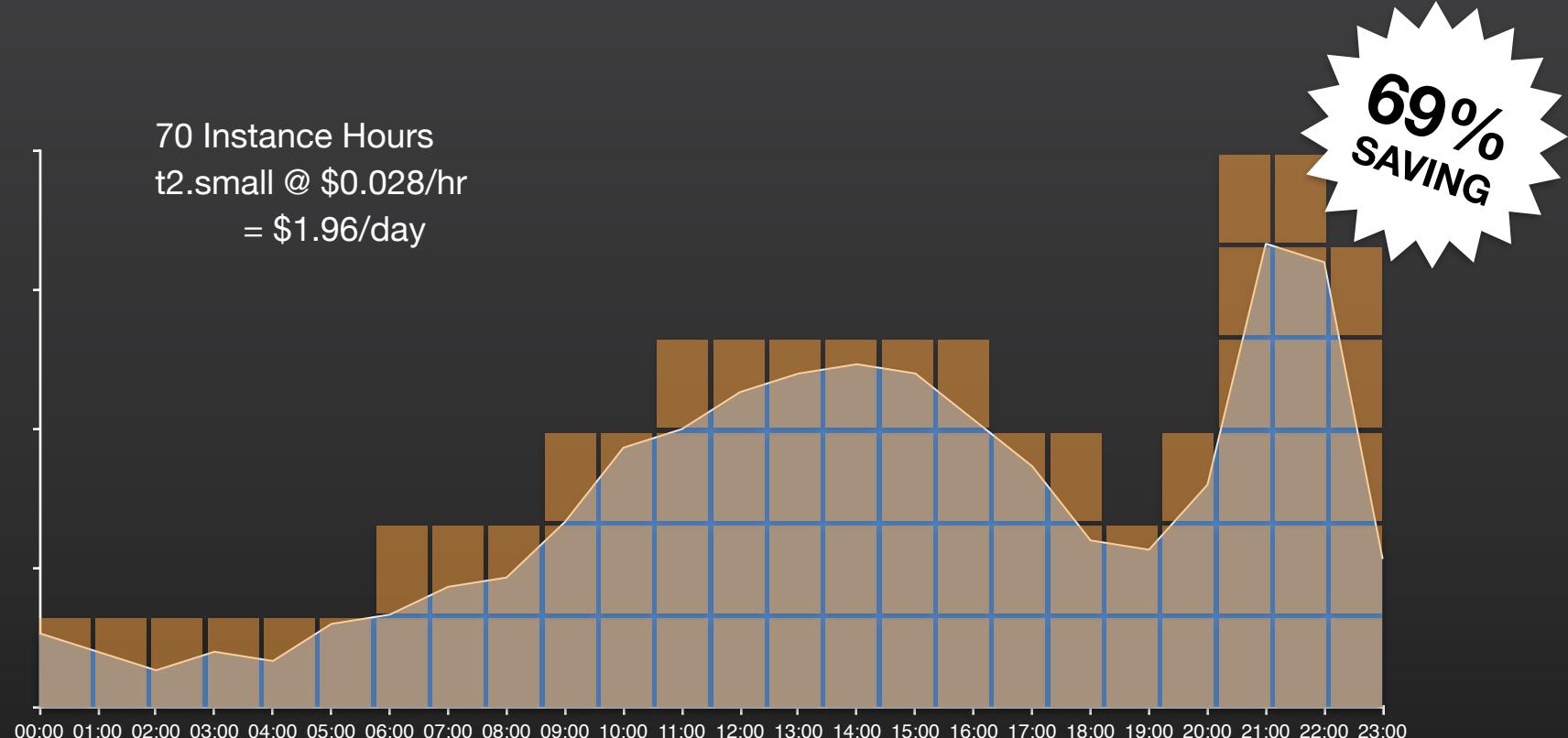
Utilisation & Auto Scaling Granularity



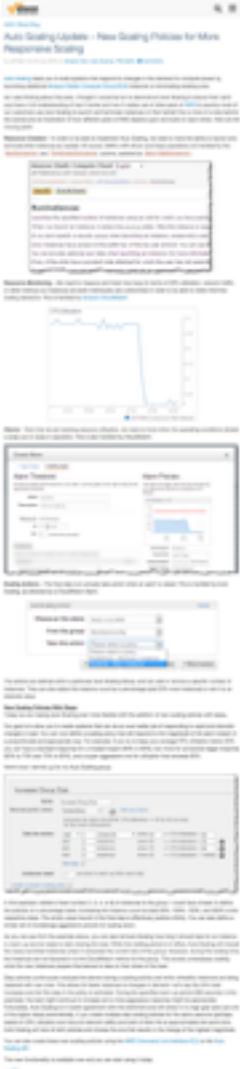
Utilisation & Auto Scaling Granularity



Utilisation & Auto Scaling Granularity



New Scaling Policies for More Responsive Scaling



Increase Group Size

Name: Increase Group Size

Execute policy when: awsec2-test-goup-CPU-Utilization [Edit](#) [Remove](#)
breaches the alarm threshold: CPUUtilization >= 50 for 300 seconds
for the metric dimensions AutoScalingGroupName = test-goup

Take the action:

Add	3	instances	when 50	<= CPUUtilization < 60	X
Add	6	instances	when 60	<= CPUUtilization < 70	X
Add	9	instances	when 70	<= CPUUtilization < 80	X
Add	12	instances	when 80	<= CPUUtilization < +infinity	X

[Add step](#) [\(i\)](#)

Instances need: 120 seconds to warm up after each step

sets each offer du maw of shndesnrt: 05T [dfer bba](#)

Ymlifitn < notfazmlluus < 08 nqfw [Sf bba](#) [sefnsstl](#) [08 nqfw](#) [Ymlifitn < notfazmlluus < 08 nqfw](#)

OTHER DEPLOYMENT OPTIONS

AWS CodeDeploy

Coordinate automated deployments, just like Amazon

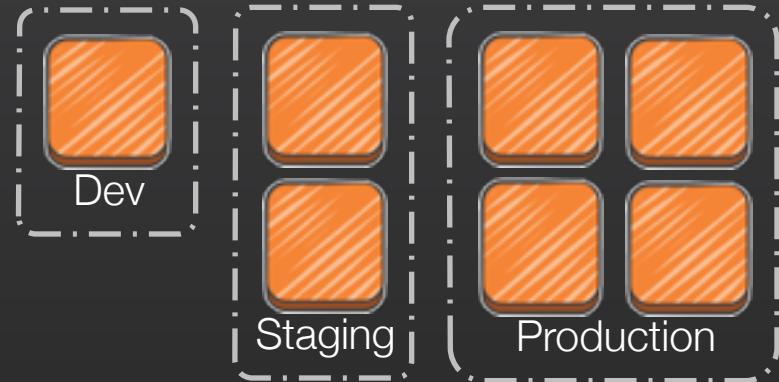
Application
Revisions



v1, v2, v3



Deployment Groups



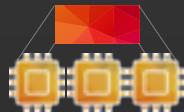
- Scale from 1 instance to thousands
- Deploy without downtime
- Centralize deployment control and monitoring
- On-Premises support

Amazon EC2 Container Service

A highly scalable, high performance container management service



Launch and terminate
Docker containers



Across a cluster
of EC2 instances



Mount persistent
volumes at launch



Private Docker
repositories

Amazon EC2 Container Service: New Features

- February – We added support for the use of images from private Docker repositories, along with support for mounting data volumes that can be used to share information between containers. After the initial launch in the US East (Northern Virginia) region, we made the service available in the US West (Oregon) region.

- March – We continued our regional expansion, heading [across the Atlantic Ocean](#) to the Europe (Ireland) region.
 - April – The service graduated to general availability, and also gained a new service scheduler for long-running applications, load balancing, rich console support, and CloudTrail integration. Expansion continued, this time with a trip across the Pacific Ocean for [availability](#) in the Asia Pacific (Tokyo) region. Regional expansion [continued](#), this time to the Asia Pacific (Sydney) region.
 - June – In three successive releases we added [support for CloudFormation](#), the ability to [remotely update the on-instance Docker and ECS agents](#), task definition deregistration, and environment variable overrides.
 - July – We added support for the use of the [UDP protocol](#) in container port task definitions.



Support coming soon for:
Docker Compose
Docker Swarm

COST OPTIMIZATION

On-Demand Instances

Pay for compute capacity by the hour with no long-term commitments or upfront payments

Reserved Instances

Provide you with a significant discount (up to 75%) compared to On-Demand Instance pricing

Spot Instances

Purchase compute capacity with no upfront commitment and at hourly rates usually lower than the On-Demand rate

Getting Started with Reserved Instances

Choosing a Reserved Instance

If you enroll in [Trusted Advisor](#) support, you can receive Reserved Instance purchase recommendations. For more information, visit the [Cost Optimization Dashboard](#) in the Amazon Trusted Advisor Console. Here are some guidelines to help you choose the right type and quantity of Reserved Instances.

Step 1: Group Instance Usage

Using the [EC2 Usage Reports](#), group Amazon EC2 instance usage by instance type, platform description, availability zone, and tenancy.

Step 2: Evaluate Cost per Group

Since the Reserved Instances provide optimal savings with "always-on" infrastructure, assess cost savings for groups of instances that are on more than 60% of the time. Compare the cost of running always-on On-Demand EC2 instance usage vs. Reserved Instances. Here are a few things to consider:

Determine the term length

What percentage of this group do I expect will be running 1 year from now? 3 years from now? Determine the number of instances you want to run and the term length (1 or 3 years).

You can find Reserved Instances with shorter term lengths and lower pricing options sold by 3rd party sellers.

Determine where your instances will reside

How likely are the instances in this group to stay within their current region? Determine the availability zone of your group. If you have instances running in EC2 classic VPC, purchase Reserved Instances with a classic-EC2 configuration.

Determine your payment option

AWS offers you [flexible payment options](#) - the more you pay up front, the lower the price of the Reserved Instance. Select a Reserved Instance that suits your needs.

Just select the instance type and quantity you need.

Amazon EC2 offers Reserved Instances with a discount of up to 70% off the price of On-Demand instances.

Determine how many Reserved Instances to buy

Determine how many Reserved Instances to buy based on the number of instances you currently have. You can purchase Reserved Instances in increments of 1 unit. For example, if you currently have 10 instances, you can purchase 10 Reserved Instances.

Purchasing and Using a Reserved Instance

The following is a helpful overview to understanding how to purchase and use a Reserved Instance from the AWS Management Console. Visit the AWS Documentation to learn how to purchase with CLI or APIs.

1. Log into the Amazon EC2 Console

Go to the [Amazon EC2 Console](#) and click "Reserved Instances" in the left navigation pane. Click on the "Purchase Reserved Instances" button.

2. Search for Reserved Instances

Specify the instance and payment attributes

3. Specify the quantity and check out

Select the Reserved Instance you'd like to purchase and specify the quantity. Reserved Instances are sold by AWS and by 3rd party sellers, who sometimes offer lower prices and shorter terms. [Click here to learn more about the Marketplace.](#)

4. Reserved Instances Cost Savings are Automatically Applied

A Reserved Instance discounted hourly rate is automatically applied to an on-demand instance which matches the instance type, availability zone, platform, and tenancy during a given hour.

For example, if you purchase two medium Linux Reserved Instances, in us-east-1a, with default tenancy, then two on-demand instances with the same attributes will benefit from the discounted hourly rate.

Modifying and Selling Reserved Instances When Your Requirements Change

1. Modifying a Reserved Instance

You can request to move your Reserved Instance to another Availability Zone within the same region, change the instance type, or change the quantity of instances.

2. Selling a Reserved Instance

Amazon EC2 allows you to sell your Reserved Instances to other users.

Get Started with Reserved Instances

Spot Instances



Spot Instances are spare Amazon EC2 instances that you can bid on.

The Spot price fluctuates in real-time based on supply and demand.

When your bid exceeds the Spot Price and spot capacity is available, your Spot instance is launched and will run until the Spot market price exceeds your bid (a Spot interruption).

**RESOURCES YOU CAN USE
TO LEARN MORE**

aws.amazon.com/ec2

Getting Started with Amazon EC2:

<http://aws.amazon.com/ec2/getting-started/>

Auto Scaling Getting Started Tutorial

<http://docs.aws.amazon.com/AutoScaling/latest/DeveloperGuide/GettingStartedTutorial.html>

AWS Training & Certification

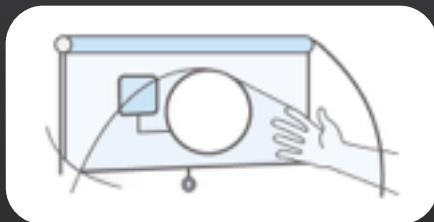
Self-Paced Labs



Try products, gain new skills, and get hands-on practice working with AWS technologies

[aws.amazon.com/training/
self-paced-labs](https://aws.amazon.com/training/self-paced-labs)

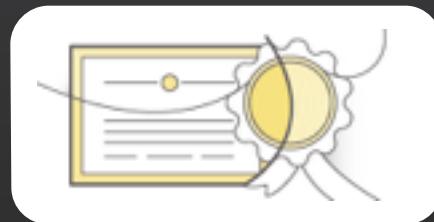
Training



Build technical expertise to design and operate scalable, efficient applications on AWS

aws.amazon.com/training

Certification



Validate your proven skills and expertise with the AWS platform

aws.amazon.com/certification

Follow us for more
events & webinars



Ian Massingham — Technical Evangelist

 @ianMmmm



@AWS_UK for local AWS events & news



@AWScloud for Global AWS News & Announcements