Elastic Load Balancing

User Guide

Elastic Load Balancing: User Guide

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What Is Elastic Load Balancing?

Elastic Load Balancing distributes incoming application or network traffic across multiple targets, such as Amazon EC2 instances, containers, and IP addresses, in multiple Availability Zones. Elastic Load Balancing scales your load balancer as traffic to your application changes over time, and can scale to the vast majority of workloads automatically.

Load Balancer Benefits

A load balancer distributes workloads across multiple compute resources, such as virtual servers. Using a load balancer increases the availability and fault tolerance of your applications.

You can add and remove compute resources from your load balancer as your needs change, without disrupting the overall flow of requests to your applications.

You can configure health checks, which are used to monitor the health of the compute resources so that the load balancer can send requests only to the healthy ones. You can also offload the work of encryption and decryption to your load balancer so that your compute resources can focus on their main work.

Features of Elastic Load Balancing

Elastic Load Balancing supports three types of load balancers: Application Load Balancers, Network Load Balancers, and Classic Load Balancers. You can select a load balancer based on your application needs. For more information, see Comparison of Elastic Load Balancing Products.

For more information about using each load balancer, see the User Guide for Application Load Balancers, the User Guide for Network Load Balancers, and the User Guide for Classic Load Balancers.

Accessing Elastic Load Balancing

You can create, access, and manage your load balancers using any of the following interfaces:

- **AWS Management Console**— Provides a web interface that you can use to access Elastic Load Balancing.
- **AWS Command Line Interface (AWS CLI)** — Provides commands for a broad set of AWS services, including Elastic Load Balancing, and is supported on Windows, Mac, and Linux. For more information, see AWS Command Line Interface.
- **AWS SDKs** — Provides language-specific APIs and takes care of many of the connection details, such as calculating signatures, handling request retries, and error handling. For more information, see AWS SDKs.
- **Query API**— Provides low-level API actions that you call using HTTPS requests. Using the Query API is the most direct way to access Elastic Load Balancing, but it requires that your application handle low-level details such as generating the hash to sign the request, and error handling. For more information, see the following:
  - Application Load Balancers and Network Load Balancers — API version 2015-12-01
  - Classic Load Balancers — API version 2012-06-01

Related Services

Elastic Load Balancing works with the following services to improve the availability and scalability of your applications.

- **Amazon EC2** — Virtual servers that run your applications in the cloud. You can configure your load balancer to route traffic to your EC2 instances. For more information, see the Amazon EC2 User Guide for Linux Instances or the Amazon EC2 User Guide for Windows Instances.
- **Amazon ECS** — Enables you to run, stop, and manage Docker containers on a cluster of EC2 instances. You can configure your load balancer to route traffic to your containers. For more information, see the Amazon Elastic Container Service Developer Guide.
- **Auto Scaling** — Ensures that you are running your desired number of instances, even if an instance fails, and enables you to automatically increase or decrease the number of instances as the demand on your instances changes. If you enable Auto Scaling with Elastic Load Balancing, instances that are launched by Auto Scaling are automatically registered with the load balancer, and instances that are terminated by Auto Scaling are automatically de-registered from the load balancer. For more information, see the Amazon EC2 Auto Scaling User Guide.
- **Amazon CloudWatch** — Enables you to monitor your load balancer and take action as needed. For more information, see the Amazon CloudWatch User Guide.
- **Route 53** — Provides a reliable and cost-effective way to route visitors to websites by translating domain names (such as `www.example.com`) into the numeric IP addresses (such as `192.0.2.1`) that computers use to connect to each other. AWS assigns URLs to your resources, such as load balancers. However, you might want a URL that is easy for users to remember. For example, you can map your domain name to a load balancer. For more information, see the Amazon Route 53 Developer Guide.

Pricing

With your load balancer, you pay only for what you use. For more information, see Elastic Load Balancing Pricing.

How Elastic Load Balancing Works

A load balancer accepts incoming traffic from clients and routes requests to its registered targets (such as EC2 instances) in one or more Availability Zones. The load balancer also monitors the health of its registered targets and ensures that it routes traffic only to healthy targets. When the load balancer detects an unhealthy target, it stops routing traffic to that target, and then resumes routing traffic to that target when it detects that the target is healthy again.

You configure your load balancer to accept incoming traffic by specifying one or more *listeners*. A listener is a process that checks for connection requests. It is configured with a protocol and port number for connections from clients to the load balancer and a protocol and port number for connections from the load balancer to the targets.

Elastic Load Balancing supports three types of load balancers: Application Load Balancers, Network Load Balancers, and Classic Load Balancers. There is a key difference between the way you configure these load balancers. With Application Load Balancers and Network Load Balancers, you register targets in target groups, and route traffic to the target groups. With Classic Load Balancers, you register instances with the load balancer.

Availability Zones and Load Balancer Nodes

When you enable an Availability Zone for your load balancer, Elastic Load Balancing creates a load balancer node in the Availability Zone. If you register targets in an Availability Zone but do not enable the Availability Zone, these registered targets do not receive traffic. Note that your load balancer is most effective if you ensure that each enabled Availability Zone has at least one registered target.

We recommend that you enable multiple Availability Zones. (Note that with an Application Load Balancer, we require you to enable multiple Availability Zones.) With this configuration, if one Availability Zone becomes unavailable or has no healthy targets, the load balancer can continue to route traffic to the healthy targets in another Availability Zone.

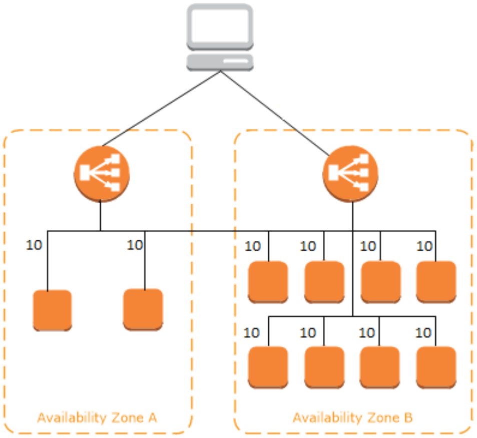
After you disable an Availability Zone, the targets in that Availability Zone remain registered with the load balancer, but the load balancer will not route traffic to them.

Cross-Zone Load Balancing

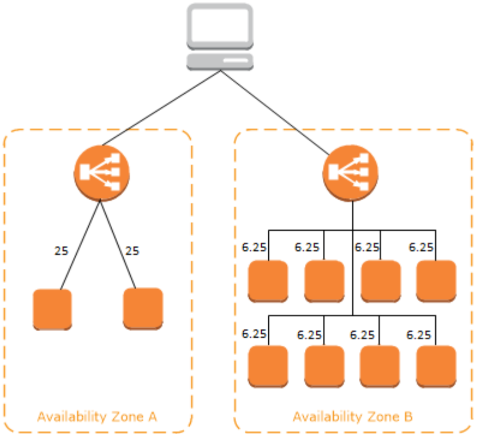
The nodes for your load balancer distribute requests from clients to registered targets. When cross-zone load balancing is enabled, each load balancer node distributes traffic across the registered targets in all enabled Availability Zones. When cross-zone load balancing is disabled, each load balancer node distributes traffic across the registered targets in its Availability Zone only.

The following diagrams demonstrate the effect of cross-zone load balancing. There are two enabled Availability Zones, with 2 targets in Availability Zone A and 8 targets in Availability Zone B. Clients send requests, and Amazon Route 53 responds to each request with the IP address of one of the load balancer nodes. This distributes traffic such that each load balancer node receives 50% of the traffic from the clients. Each load balancer node distributes its share of the traffic across the registered targets in its scope.

If cross-zone load balancing is enabled, each of the 10 targets receives 10% of the traffic. This is because each load balancer node can route its 50% of the client traffic to all 10 targets.



If cross-zone load balancing is disabled, each of the 2 targets in Availability Zone A receives 25% of the traffic and each of the 8 targets in Availability Zone B receives 6.25% of the traffic. This is because each load balancer node can route its 50% of the client traffic only to targets in its Availability Zone.



With Application Load Balancers, cross-zone load balancing is always enabled.

With Network Load Balancers, cross-zone load balancing is disabled by default. After you create a Network Load Balancer, you can enable or disable cross-zone load balancing at any time. For more information, see Cross-Zone Load Balancing in the *User Guide for Network Load Balancers*.

When you create a Classic Load Balancer, the default for cross-zone load balancing depends on how you create the load balancer. With the API or CLI, cross-zone load balancing is disabled by default. With the AWS Management Console, the option to enable cross-zone load balancing is selected by default. After you create a Classic Load Balancer, you can enable or disable cross-zone load balancing at any time. For more information, see Enable Cross-Zone Load Balancing in the *User Guide for Classic Load Balancers*.

Request Routing

Before a client sends a request to your load balancer, it resolves the load balancer's domain name using a Domain Name System (DNS) server. The DNS entry is controlled by Amazon, because your load balancers are in the `amazonaws.com` domain. The Amazon DNS servers return one or more IP addresses to the client, which are the IP addresses of the load balancer nodes for your load balancer. With Network Load Balancers, Elastic Load Balancing creates a network interface for each Availability Zone you enable. Each load balancer node in the Availability Zone uses this network interface to get a static IP address. You can optionally associate one Elastic IP address with each network interface when you create the load balancer.

As traffic to your application changes over time, Elastic Load Balancing scales your load balancer and updates the DNS entry. Note that the DNS entry also specifies the time-to-live (TTL) as 60 seconds, which ensures that the IP addresses can be remapped quickly in response to changing traffic.

The client determines which IP address to use to send requests to the load balancer. The load balancer node that receives the request selects a healthy registered target and sends the request to the target using its private IP address.

Routing Algorithm

With Application Load Balancers, the load balancer node that receives the request evaluates the listener rules in priority order to determine which rule to apply, and then selects a target from the target group for the rule action using the round robin routing algorithm. Routing is performed independently for each target group, even when a target is registered with multiple target groups.

With Network Load Balancers, the load balancer node that receives the connection selects a target from the target group for the default rule using a flow hash algorithm, based on the protocol, source IP address, source port, destination IP address, destination port, and TCP sequence number. The TCP connections from a client have different source ports and sequence numbers, and can be routed to different targets. Each individual TCP connection is routed to a single target for the life of the connection.

With Classic Load Balancers, the load balancer node that receives the request selects a registered instance using the round robin routing algorithm for TCP listeners and the least outstanding requests routing algorithm for HTTP and HTTPS listeners.

HTTP Connections

Classic Load Balancers use pre-open connections but Application Load Balancers do not. Both Classic Load Balancers and Application Load Balancers use connection multiplexing. This means that requests from multiple clients on multiple front-end connections can be routed to a given target through a single back-end connection. Connection multiplexing improves latency and reduces the load on your applications. To prevent connection multiplexing, disable HTTP keep-alives by setting the `Connection: close` header in your HTTP responses.

Classic Load Balancers support the following protocols on front-end connections (client to load balancer): HTTP/0.9, HTTP/1.0, and HTTP/1.1.

Application Load Balancers support the following protocols on front-end connections: HTTP/0.9, HTTP/1.0, HTTP/1.1, and HTTP/2. You can use HTTP/2 only with HTTPS listeners, and send up to 128 requests in parallel using one HTTP/2 connection. Application Load Balancers also support connection upgrades from HTTP to Websockets.

Both Application Load Balancers and Classic Load Balancers use HTTP/1.1 on back-end connections (load balancer to registered target). Keep-alive is supported on back-end connections by default. For HTTP/1.0 requests from clients that do not have a host header, the load balancer generates a host header for the HTTP/1.1 requests sent on the back-end connections. For Application Load Balancer, the host header contains the DNS name of the load balancer. For Classic Load Balancer, the host header contains the IP address of the load balancer node.

You can set an idle timeout value for both Application Load Balancers and Classic Load Balancers. The default value is 60 seconds. With an Application Load Balancer, the idle timeout value applies only to front-end connections. With a Classic Load Balancer, if a front-end connection or a back-end connection is idle for longer than the idle timeout value, the connection is torn down and the client receives an error response. A registered target can use a keep-alive timeout to keep a back-end connection open until it is ready to tear it down.

Application Load Balancers and Classic Load Balancers support pipelined HTTP on front-end connections. They do not support pipelined HTTP on back-end connections.

HTTP Headers

Application Load Balancers and Classic Load Balancers support **X-Forwarded-For**, **X-Forwarded-Proto**, and **X-Forwarded-Port** headers.

For front-end connections that use HTTP/2, the header names are in lowercase. Before the request is sent to the target using HTTP/1.1, the following header names are converted to mixed case: **X-Forwarded-For**, **X-Forwarded-Proto**, **X-Forwarded-Port**, **Host**, **X-Amzn-Trace-Id**, **Upgrade**, and **Connection**. All other header names are in lowercase.

Application Load Balancers and Classic Load Balancers honor the connection header from the incoming client request after proxying the response back to the client.

HTTP headers for Application Load Balancers have the following size limits:

- Request line: 16K
- Single header: 16K
- Whole header: 64K

Load Balancer Scheme

When you create a load balancer, you must choose whether to make it an internal load balancer or an Internet-facing load balancer. Note that when you create a Classic Load Balancer in EC2-Classic, it must be an Internet-facing load balancer.

The nodes of an Internet-facing load balancer have public IP addresses. The DNS name of an Internet-facing load balancer is publicly resolvable to the public IP addresses of the nodes. Therefore, Internet-facing load balancers can route requests from clients over the Internet.

The nodes of an internal load balancer have only private IP addresses. The DNS name of an internal load balancer is publicly resolvable to the private IP addresses of the nodes. Therefore, internal load balancers can only route requests from clients with access to the VPC for the load balancer.

Note that both Internet-facing and internal load balancers route requests to your targets using private IP addresses. Therefore, your targets do not need public IP addresses to receive requests from an internal or an Internet-facing load balancer.

If your application has multiple tiers, for example web servers that must be connected to the Internet and database servers that are only connected to the web servers, you can design an architecture that uses both internal and Internet-facing load balancers. Create an Internet-facing load balancer and register the web servers with it. Create an internal load balancer and register the database servers with it. The web servers receive requests from the Internet-facing load balancer and send requests for the database servers to the internal load balancer. The database servers receive requests from the internal load balancer.

Getting Started with Elastic Load Balancing

There are three types of load balancers: Application Load Balancers, Network Load Balancers, and Classic Load Balancers. You can select a load balancer based on your application needs. For more information, see Comparison of Elastic Load Balancing Products.

If you have an existing Classic Load Balancer, you can migrate to an Application Load Balancer or a Network Load Balancer. For more information, see Migrate Your Classic Load Balancer (p. 18).

Create an Application Load Balancer

To create an Application Load Balancer using the AWS Management Console, see Getting Started with Application Load Balancers in the *User Guide for Application Load Balancers*.

To create an Application Load Balancer using the AWS CLI, see Create an Application Load Balancer Using the AWS CLI in the *User Guide for Application Load Balancers*.

Create a Network Load Balancer

To create a Network Load Balancer using the AWS Management Console, see Getting Started with Network Load Balancers in the *User Guide for Network Load Balancers*.

To create a Network Load Balancer using the AWS CLI, see Create a Network Load Balancer Using the AWS CLI in the *User Guide for Network Load Balancers*.

Create a Classic Load Balancer

To create a Classic Load Balancer using the AWS Management Console, see Create a Classic Load Balancer in the *User Guide for Classic Load Balancers*.

Authentication and Access Control for Your Load Balancers

AWS uses security credentials to identify you and to grant you access to your AWS resources. You can use features of AWS Identity and Access Management (IAM) to allow other users, services, and applications to use your AWS resources fully or in a limited way, without sharing your security credentials.

By default, IAM users don't have permission to create, view, or modify AWS resources. To allow an IAM user to access resources, such as a load balancer, and perform tasks, you must create an IAM policy that grants the IAM user permission to use the specific resources and API actions they'll need, then attach the policy to the IAM user or the group the IAM user belongs to. When you attach a policy to a user or group of users, it allows or denies the users permission to perform the specified tasks on the specified resources.

For example, you can use IAM to create users and groups under your AWS account (an IAM user can be a person, a system, or an application). Then you grant permissions to the users and groups to perform specific actions on the specified resources using an IAM policy.

Grant Permissions Using IAM Policies

When you attach a policy to a user or group of users, it allows or denies the users permission to perform the specified tasks on the specified resources.

An IAM policy is a JSON document that consists of one or more statements. Each statement is structured as follows:

```
{
  "Version": "2012-10-17",
  "Statement":[{
    "Effect": "effect",
    "Action": "action",
    "Resource": "resource-arn",
    "Condition": {
      "condition": {
        "key":"value"
      }
    }
  }]
}
```

- **Effect**— The *effect* can be `Allow` or `Deny`. By default, IAM users don't have permission to use resources and API actions, so all requests are denied. An explicit allow overrides the default. An explicit deny overrides any allows.
- **Action**— The *action* is the specific API action for which you are granting or denying permission. For more information about specifying *action*, see API Actions for Elastic Load Balancing (p. 9).
- **Resource**— The resource that's affected by the action. With many Elastic Load Balancing API actions, you can restrict the permissions granted or denied to a specific load balancer by specifying its Amazon Resource Name (ARN) in this statement. Otherwise, you can use the * wildcard to specify all of your load balancers. For more information, see Elastic Load Balancing Resources (p. 9).

- **Condition**— You can optionally use conditions to control when your policy is in effect. For more information, see Condition Keys for Elastic Load Balancing (p. 12).

For more information, see the IAM User Guide.

API Actions for Elastic Load Balancing

In the **Action** element of your IAM policy statement, you can specify any API action that Elastic Load Balancing offers. You must prefix the action name with the lowercase string `elasticloadbalancing:`, as shown in the following example:

```
"Action": "elasticloadbalancing:DescribeLoadBalancers"
```

To specify multiple actions in a single statement, enclose them in square brackets and separate them with a comma, as follows:

```
"Action": [
    "elasticloadbalancing:DescribeLoadBalancers",
    "elasticloadbalancing:DeleteLoadBalancer"
]
```

You can also specify multiple actions using the * wildcard. The following example specifies all API action names for Elastic Load Balancing that start with `Describe`:

```
"Action": "elasticloadbalancing:Describe*"
```

To specify all API actions for Elastic Load Balancing, use the * wildcard, as in the following example:

```
"Action": "elasticloadbalancing:*"
```

For the complete list of the API actions for Elastic Load Balancing, see the following documentation:

- Application Load Balancers and Network Load Balancers — API Reference version 2015-12-01
- Classic Load Balancers — API Reference version 2012-06-01

Elastic Load Balancing Resources

Resource-level permissions refers to the ability to specify which resources users are allowed to perform actions on. Elastic Load Balancing has partial support for resource-level permissions. For API actions that support resource-level permissions, you can control the resources that users are allowed to use with the action. To specify a resource in a policy statement, you must use its Amazon Resource Name (ARN). When specifying an ARN, you can use the * wildcard in your paths; for example, when you do not want to specify the exact load balancer name.

The ARN for an Application Load Balancer has the following format:

```
arn:aws:elasticloadbalancing:region-code:account-id:loadbalancer/app/load-balancer-
name/load-balancer-id
```

The ARN for a Network Load Balancer has the following format:

```
arn:aws:elasticloadbalancing:region-code:account-id:loadbalancer/net/load-balancer-name/load-balancer-id
```

The ARN for a Classic Load Balancer has the following format:

```
arn:aws:elasticloadbalancing:region-code:account-id:loadbalancer/load-balancer-name
```

The ARNs for a listener and a listener rule for an Application Load Balancer have the following format:

```
arn:aws:elasticloadbalancing:region-code:account-id:listener/app/load-balancer-name/load-balancer-id/listener-id
arn:aws:elasticloadbalancing:region-code:account-id:listener-rule/app/load-balancer-name/load-balancer-id/listener-id/rule-id
```

The ARN for a listener for a Network Load Balancer has the following format:

```
arn:aws:elasticloadbalancing:region-code:account-id:listener/net/load-balancer-name/load-balancer-id/listener-id
```

The ARN for a target group has the following format:

```
arn:aws:elasticloadbalancing:region-code:account-id:targetgroup/target-group-name/target-group-id
```

API Actions with No Support for Resource-Level Permissions

The following Elastic Load Balancing actions do not support resource-level permissions:

- API version 2015-12-01:
  - `DescribeAccountLimits`
  - `DescribeListenerCertificates`
  - `DescribeListeners`
  - `DescribeLoadBalancerAttributes`
  - `DescribeLoadBalancers`
  - `DescribeRules`
  - `DescribeSSLPolicies`
  - `DescribeTags`
  - `DescribeTargetGroupAttributes`
  - `DescribeTargetGroups`
  - `DescribeTargetHealth`
- API version 2012-06-01:
  - `DescribeInstanceHealth`
  - `DescribeLoadBalancerAttributes`
  - `DescribeLoadBalancerPolicyTypes`
  - `DescribeLoadBalancers`
  - `DescribeLoadBalancerPolicies`
  - `DescribeTags`

For API actions that don't support resource-level permissions, you must specify the following resource statement:

```
"Resource": "*"
```

Resource-Level Permissions for Elastic Load Balancing

The following tables describe the Elastic Load Balancing actions that support resource-level permissions, as well as the supported resources for each action.

API version 2015-12-01

API Action	Resource ARNs
`AddListenerCertificates`	listener
`AddTags`	load balancer, target group
`CreateListener`	load balancer
`CreateLoadBalancer`	load balancer
`CreateRule`	listener
`CreateTargetGroup`	target group
`DeleteListener`	listener
`DeleteLoadBalancer`	load balancer
`DeleteRule`	listener rule
`DeleteTargetGroup`	target group
`DeregisterTargets`	target group
`ModifyListener`	listener
`ModifyLoadBalancerAttributes`	load balancer
`ModifyRule`	listener rule
`ModifyTargetGroup`	target group
`ModifyTargetGroupAttributes`	target group
`RegisterTargets`	target group
`RemoveListenerCertificates`	listener
`RemoveTags`	load balancer, target group
`SetIpAddressType`	load balancer
`SetRulePriorities`	listener rule
`SetSecurityGroups`	load balancer

API Action	Resource ARNs
SetSubnets	load balancer

API version 2012-06-01

API Action	Resource ARNs
AddTags	load balancer
ApplySecurityGroupsToLoadBalancer	load balancer
AttachLoadBalancerToSubnets	load balancer
ConfigureHealthCheck	load balancer
CreateAppCookieStickinessPolicy	load balancer
CreateLBCookieStickinessPolicy	load balancer
CreateLoadBalancer	load balancer
CreateLoadBalancerListeners	load balancer
CreateLoadBalancerPolicy	load balancer
DeleteLoadBalancer	load balancer
DeleteLoadBalancerListeners	load balancer
DeleteLoadBalancerPolicy	load balancer
DeregisterInstancesFromLoadBalancer	load balancer
DetachLoadBalancerFromSubnets	load balancer
DisableAvailabilityZonesForLoadBalancer	load balancer
EnableAvailabilityZonesForLoadBalancer	load balancer
ModifyLoadBalancerAttributes	load balancer
RegisterInstancesWithLoadBalancer	load balancer
RemoveTags	load balancer
SetLoadBalancerListenerSSLCertificate	load balancer
SetLoadBalancerPoliciesForBackendServer	load balancer
SetLoadBalancerPoliciesOfListener	load balancer

Condition Keys for Elastic Load Balancing

When you create a policy, you can specify the conditions that control when the policy is in effect. Each condition contains one or more key-value pairs. There are global condition keys and service-specific condition keys.

The `elasticloadbalancing:ResourceTag/`*`key`* condition key is specific to Elastic Load Balancing. The following actions support this condition key:

- `AddTags`
- `CreateListener`
- `CreateLoadBalancer`
- `DeleteLoadBalancer`
- `DeleteTargetGroup`
- `DeregisterTargets`
- `ModifyLoadBalancerAttributes`
- `ModifyTargetGroup`
- `ModifyTargetGroupAttributes`
- `RegisterTargets`
- `RemoveTags`
- `SetIpAddressType`
- `SetSecurityGroups`
- `SetSubnets`

For more information about global condition keys, see AWS Global Condition Context Keys in the *IAM User Guide*.

The following actions support the `aws:RequestTag/`*`key`* and `aws:TagKeys` condition keys:

- `AddTags`
- `CreateLoadBalancer`
- `RemoveTags`

Elastic Load Balancing API Permissions

You must grant IAM users permission to call the Elastic Load Balancing API actions they need, as described in API Actions for Elastic Load Balancing (p. 9). In addition, for some Elastic Load Balancing actions, you must grant IAM users permission to call specific actions from the Amazon EC2 API.

Required Permissions for the 2015-12-01 API

When calling the following actions from the 2015-12-01 API, you must grant IAM users permission to call the specified actions.

`CreateLoadBalancer`

- `elasticloadbalancing:CreateLoadBalancer`
- `ec2:DescribeAccountAttributes`
- `ec2:DescribeAddresses`
- `ec2:DescribeInternetGateways`
- `ec2:DescribeSecurityGroups`
- `ec2:DescribeSubnets`
- `ec2:DescribeVpcs`
- `iam:CreateServiceLinkedRole`

`CreateTargetGroup`

- `elasticloadbalancing:CreateTargetGroup`
- `ec2:DescribeInternetGateways`
- `ec2:DescribeVpcs`

`RegisterTargets`

- `elasticloadbalancing:RegisterTargets`
- `ec2:DescribeInstances`
- `ec2:DescribeInternetGateways`
- `ec2:DescribeSubnets`
- `ec2:DescribeVpcs`

`SetIpAddressType`

- `elasticloadbalancing:SetIpAddressType`
- `ec2:DescribeSubnets`

`SetSubnets`

- `elasticloadbalancing:SetSubnets`
- `ec2:DescribeSubnets`

Required Permissions for the 2012-06-01 API

When calling the following actions from the 2012-06-01 API, you must grant IAM users permission to call the specified actions.

`ApplySecurityGroupsToLoadBalancer`

- `elasticloadbalancing:ApplySecurityGroupsToLoadBalancer`
- `ec2:DescribeAccountAttributes`
- `ec2:DescribeSecurityGroups`

`AttachLoadBalancerToSubnets`

- `elasticloadbalancing:AttachLoadBalancerToSubnets`
- `ec2:DescribeSubnets`

`CreateLoadBalancer`

- `elasticloadbalancing:CreateLoadBalancer`
- `ec2:CreateSecurityGroup`
- `ec2:DescribeAccountAttributes`
- `ec2:DescribeInternetGateways`
- `ec2:DescribeSecurityGroups`
- `ec2:DescribeSubnets`
- `ec2:DescribeVpcs`
- `iam:CreateServiceLinkedRole`

`DeregisterInstancesFromLoadBalancer`

- `elasticloadbalancing:DeregisterInstancesFromLoadBalancer`
- `ec2:DescribeClassicLinkInstances`
- `ec2:DescribeInstances`

`DescribeInstanceHealth`

- `elasticloadbalancing:DescribeInstanceHealth`
- `ec2:DescribeClassicLinkInstances`
- `ec2:DescribeInstances`

`DescribeLoadBalancers`

- `elasticloadbalancing:DescribeLoadBalancers`
- `ec2:DescribeSecurityGroups`

`DisableAvailabilityZonesForLoadBalancer`

- `elasticloadbalancing:DisableAvailabilityZonesForLoadBalancer`
- `ec2:DescribeAccountAttributes`
- `ec2:DescribeInternetGateways`
- `ec2:DescribeVpcs`

`EnableAvailabilityZonesForLoadBalancer`

- `elasticloadbalancing:EnableAvailabilityZonesForLoadBalancer`
- `ec2:DescribeAccountAttributes`
- `ec2:DescribeInternetGateways`
- `ec2:DescribeSubnets`
- `ec2:DescribeVpcs`

`RegisterInstancesWithLoadBalancer`

- `elasticloadbalancing:RegisterInstancesWithLoadBalancer`
- `ec2:DescribeAccountAttributes`
- `ec2:DescribeClassicLinkInstances`
- `ec2:DescribeInstances`
- `ec2:DescribeVpcClassicLink`

Example Policies

The following example policies show how you can control the permissions that IAM users have to use Elastic Load Balancing.

Example Example: Grant Full Access

The following policy grants users permission to use all Elastic Load Balancing API actions, the `CreateSecurityGroup` Amazon EC2 action, and all Amazon EC2 actions whose names begin with `Describe`. This enables them to create, update, get information about, and delete Elastic Load Balancing resources.

```
{
   "Version": "2012-10-17",
   "Statement": [{
      "Effect": "Allow",
      "Action": [
          "elasticloadbalancing:*",
          "ec2:CreateSecurityGroup",
          "ec2:Describe*"
      ],
      "Resource": "*"
    }
   ]
}
```

Example Example: Grant Read-Only Access

The following policy grants users permission to use all Elastic Load Balancing and Amazon EC2 actions whose names begin with `Describe`. This enables them to get information about Elastic Load Balancing resources.

```
{
   "Version": "2012-10-17",
   "Statement": [{
      "Effect": "Allow",
      "Action": [
          "elasticloadbalancing:Describe*",
          "ec2:Describe*"
      ],
      "Resource": "*"
    }
   ]
}
```

Elastic Load Balancing Service-Linked Role

Elastic Load Balancing uses a service-linked role for the permissions that it requires to call other AWS services on your behalf. For more information, see Using Service-Linked Roles in the *IAM User Guide*.

Permissions Granted by the Service-Linked Role

Elastic Load Balancing uses the service-linked role named **AWSServiceRoleForElasticLoadBalancing** to call the following actions on your behalf:

- `ec2:DescribeAddresses`
- `ec2:DescribeInstances`
- `ec2:DescribeSubnets`
- `ec2:DescribeSecurityGroups`
- `ec2:DescribeVpcs`
- `ec2:DescribeInternetGateways`
- `ec2:DescribeAccountAttributes`
- `ec2:DescribeClassicLinkInstances`
- `ec2:DescribeVpcClassicLink`
- `ec2:CreateSecurityGroup`
- `ec2:CreateNetworkInterface`
- `ec2:DeleteNetworkInterface`
- `ec2:ModifyNetworkInterface`
- `ec2:ModifyNetworkInterfaceAttribute`
- `ec2:AuthorizeSecurityGroupIngress`
- `ec2:AssociateAddress`
- `ec2:DisassociateAddress`
- `ec2:AttachNetworkInterface`
- `ec2:DetachNetworkInterface`
- `ec2:AssignPrivateIpAddresses`
- `ec2:AssignIpv6Addresses`
- `ec2:UnassignIpv6Addresses`
- `logs:CreateLogDelivery`
- `logs:GetLogDelivery`
- `logs:UpdateLogDelivery`
- `logs:DeleteLogDelivery`

- `logs:ListLogDeliveries`

AWSServiceRoleForElasticLoadBalancing trusts the `elasticloadbalancing.amazonaws.com` service to assume the role.

Create the Service-Linked Role

You don't need to manually create the **AWSServiceRoleForElasticLoadBalancing** role. Elastic Load Balancing creates this role for you when you create a load balancer.

If you created a load balancer before January 11, 2018, Elastic Load Balancing created **AWSServiceRoleForElasticLoadBalancing** in your AWS account. For more information, see A New Role Appeared in My AWS Account in the *IAM User Guide*.

Edit the Service-Linked Role

You can edit the description of **AWSServiceRoleForElasticLoadBalancing** using IAM. For more information, see Editing a Service-Linked Role in the *IAM User Guide*.

Delete the Service-Linked Role

If you no longer need to use Elastic Load Balancing, we recommend that you delete **AWSServiceRoleForElasticLoadBalancing**.

You can delete this service-linked role only after you delete all load balancers in your AWS account. This ensures that you can't inadvertently remove permission to access your load balancers. For more information, see Delete an Application Load Balancer, Delete a Network Load Balancer, and Delete a Classic Load Balancer.

You can use the IAM console, the IAM CLI, or the IAM API to delete service-linked roles. For more information, see Deleting a Service-Linked Role in the *IAM User Guide*.

After you delete **AWSServiceRoleForElasticLoadBalancing**, Elastic Load Balancing creates the role again if you create a load balancer.

Migrate Your Classic Load Balancer

If you have an existing Classic Load Balancer in a VPC and you have determined that an Application Load Balancer or a Network Load Balancer would meet your needs, you can migrate your Classic Load Balancer. After you have completed the migration process, you can take advantage of the features of your new load balancer. For more information, see Comparison of Elastic Load Balancing Products.

Migration Process

- Step 1: Create a New Load Balancer (p. 18)
- Step 2: Gradually Redirect Traffic to Your New Load Balancer (p. 20)
- Step 3: Update References to Your Classic Load Balancer (p. 20)
- Step 4: Delete the Classic Load Balancer (p. 21)

Step 1: Create a New Load Balancer

Create an Application Load Balancer or a Network Load Balancer with a configuration that is equivalent to your Classic Load Balancer.

You can create the load balancer and target group using one of the following methods:

- Migration wizard in the console (p. 18)
- Load Balancer Copy Utility (p. 19)
- Manually (p. 19)

Option 1: Migrate Using the Migration Wizard

The migration wizard creates an Application Load Balancer or Network Load Balancer based on the configuration of your Classic Load Balancer. The type of load balancer created depends on configuration of the Classic Load Balancer.

Migration Wizard Release Notes

- The Classic Load Balancer must be in a VPC.
- If the Classic Load Balancer has an HTTP or HTTPS listener, the wizard can create an Application Load Balancer. If the Classic Load Balancer has a TCP listener, the wizard can create a Network Load Balancer.
- If the name of the Classic Load Balancer matches the name of an existing Application Load Balancer or Network Load Balancer, the wizard requires that you specify a different name for the new load balancer.
- If the Classic Load Balancer has one subnet, the wizard requires that you specify a second subnet when creating an Application Load Balancer.
- If the Classic Load Balancer has registered instances in EC2-Classic, they are not registered with the target group for the new load balancer.
- If the Classic Load Balancer has registered instances of the following types, they are not registered with the target group for a Network Load Balancer: C1, CC1, CC2, CG1, CG2, CR1, CS1, G1, G2, HI1, HS1, M1, M2, M3, and T1.

- If the Classic Load Balancer has HTTP/HTTPS listeners but uses TCP health checks, the wizard changes to HTTP health checks and sets the path to "/" by default when creating an Application Load Balancer.
- If the Classic Load Balancer is migrated to a Network Load Balancer, the health check settings are changed to meet the requirements for Network Load Balancers.
- If the Classic Load Balancer has multiple HTTPS listeners, the wizard chooses one and uses its certificate and policy. If there is an HTTPS listener on port 443, the wizard chooses this listener. If the chosen listener uses a custom policy or a policy not supported for Application Load Balancers, the wizard changes to the default security policy.
- If the Classic Load Balancer has a secure TCP listener, the Network Load Balancer uses a TCP listener but does not use the certificate or security policy.
- If the Classic Load Balancer has multiple listeners, the wizard uses the listener port with the lowest value as the target group port. Each instance registered with these listeners is registered with the target group on the listener ports for all the listeners.
- If the Classic Load Balancer has tags with the `aws` prefix in the tag name, these tags are not added to the new load balancer.

To migrate a Classic Load Balancer using the migration wizard

1. Open the Amazon EC2 console at https://console.aws.amazon.com/ec2/.
2. On the navigation pane, under **LOAD BALANCING**, choose **Load Balancers**.
3. Select your Classic Load Balancer.
4. On the **Migration** tab, choose **Launch ALB Migration Wizard** or **Launch NLB Migration Wizard**. The button displayed depends on the load balancer type selected by the wizard after examining your Classic Load Balancer.
5. On the **Review** page, verify the configuration options selected by the wizard. To change an option, choose **Edit**.
6. When you are finished configuring the new load balancer, choose **Create**.

Option 2: Migrate Using the Load Balancer Copy Utility

This utility is available on GitHub. For more information, see Load Balancer Copy Utility.

Option 3: Migrate Manually

The following is the general process to create a new load balancer based on a Classic Load Balancer manually. You can migrate using the AWS Management Console, the AWS CLI, or an AWS SDK. For more information, see Getting Started with Elastic Load Balancing (p. 7).

- Create a new load balancer, with the same scheme (Internet-facing or internal), subnets, and security groups as the Classic Load Balancer.
- Create one target group for your load balancer, with the same health check settings that you have for your Classic Load Balancer.
- Do one of the following:
  - If your Classic Load Balancer is attached to an Auto Scaling group, attach your target group to the Auto Scaling group. This also registers the Auto Scaling instances with the target group.
  - Register your EC2 instances with your target group.
- Create one or more listeners, each with a default rule that forwards requests to the target group. If you create an HTTPS listener, you can specify the same certificate that you specified for your Classic Load Balancer. We recommend that you use the default security policy.

- If your Classic Load Balancer has tags, review them and add the relevant tags to your new load balancer.

Step 2: Gradually Redirect Traffic to Your New Load Balancer

After your instances are registered with your new load balancer, you can begin the process of testing your new load balancer as you gradually redirect traffic.

To redirect traffic gradually to your new load balancer

1. Paste the DNS name of your new load balancer into the address field of an internet-connected web browser. If everything is working, the browser displays the default page of your server.
2. Create a new DNS record that associates your domain name with your new load balancer. If your DNS service supports weighting, specify a weight of 1 in the new DNS record and a weight of 9 in the existing DNS record for your Classic Load Balancer. This directs 10% of the traffic to the new load balancer and 90% of the traffic to the Classic Load Balancer.
3. Monitor your new load balancer to verify that it is receiving traffic and routing requests to your instances.

   Important
   The time-to-live (TTL) in the DNS record is 60 seconds, which means that any DNS server that resolves your domain name keeps the record information in its cache for 60 seconds. Therefore, these DNS servers can still route traffic to your Classic Load Balancer for up to 60 seconds after you complete the previous step and the changes start to propagate to DNS servers around the world. During propagation, traffic could be directed to either load balancer.
4. Continue to update the weight of your DNS records until all traffic is directed to your new load balancer. When you are finished, you can delete the DNS record for your Classic Load Balancer.

Step 3: Update References to Your Classic Load Balancer

Now that you have migrated your Classic Load Balancer, be sure to update any references to it, such as the following:

- Scripts that use the AWS CLI **aws elb** commands (instead of the **aws elbv2** commands)
- Code that uses Elastic Load Balancing API version 2012-06-01 (instead of version 2015-12-01)
- IAM policies that use API version 2012-06-01 (instead of version 2015-12-01)
- Processes that use CloudWatch metrics
- AWS CloudFormation templates

Resources

- elbv2 in the *AWS CLI Command Reference*
- Elastic Load Balancing API Reference version 2015-12-01
- Authentication and Access Control for Your Load Balancers (p. 8)
- Application Load Balancer Metrics in the *User Guide for Application Load Balancers*

- Network Load Balancer Metrics in the *User Guide for Network Load Balancers*
- AWS::ElasticLoadBalancingV2::LoadBalancer in the *AWS CloudFormation User Guide*

Step 4: Delete the Classic Load Balancer

After you've redirected all traffic to the new load balancer and all existing requests that were routed to the Classic Load Balancer have completed, you can delete the Classic Load Balancer.