

# AWS EC2 Reserved Instances

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## Why?

Reserved Instances at AWS provide a significant discount (up to 75%) compared to On-Demand pricing and can provide a capacity reservation when used in a specific Availability Zone.

## Types

### Reserved Instances

- Standard Reserved Instances
  - Apply to a single instance family, platform, scope, and tenancy over a term
  - One or three year term
  - Can reserve capacity (locked into one availability zone, "zonal RI") or be regional (can launch in any AZ within the region, "regional RI")
  - Associated with one region for duration of term
  - Greatest discount
- Convertible Reserved Instances
  - They allow you to change the instance family and other parameters associated with a Reserved Instance at any time. For example, you can convert C3 RIs to C4 RIs to take advantage of a newer instance type, or convert C4 RIs to M4 RIs if your application turns out to need more memory.
  - Can exchange a portion of remaining CRI to a different family
  - Can merge two or more CRIs and obtain one for a larger instance
    - Merged CRIs will have the expiry date of the RI that is furthest from the date of exchange
    - Merging CRIs with different term lengths always produces a 3 year CRI
  - One or three year term
  - Can reserve capacity (locked into one availability zone) or be regional (can launch in any AZ within the region)
  - Associated with one region for duration of term
  - Slightly more expensive than Standard RI
  - Note : You cannot convert your Convertible Reserved Instance for Convertible Reserved Instance(s) of a lesser total value.

### Scheduled Instances

- One year term
- Repeating schedule (daily, weekly, monthly)
- <http://docs.aws.amazon.com/AWSEC2/latest/UserGuide/ec2-scheduled-instances.html>

## Tenancy

- If you're using dedicated instances, choose Dedicated Tenancy
- If not, choose Default Tenancy

## Usage

### Instance Size Flexibility

- All Regional Linux/UNIX RIs with shared tenancy now apply to all sizes of instances within an instance family and AWS region, even if you are using them across multiple accounts via [Consolidated Billing](#).
- RIs with Instance Size Flexibility use a concept of normalized units to apply billing credits.
- Let's say you already own an RI for a c4.8xlarge (normalization factor of 64). This RI now applies to any usage of a Linux/UNIX C4 instance with shared tenancy in the region. This could be:
  - One c4.8xlarge instance.
  - Two c4.4xlarge (normalization factor of 32 each) instances (64 total).
  - Four c4.2xlarge (normalization factor of 16 each) instances (64 total).

- Sixteen c4.large (normalization factor of 4 each) instances (64 total).
  - It also includes other combinations such as one c4.xlarge and eight c4.large instances.
- If you own an RI that has a smaller normalization factor than the instance that you are running, you will be charged the pro-rated, On-Demand price for the excess.
- If you own an RI for a large instance and run a smaller instance, the RI price will apply to the smaller instance. However, the unused portion of the reservation will not accumulate.



Instance size flexibility does not apply to Windows, Windows with SQL Standard, Windows with SQL Server Enterprise, Windows with SQL Server Web, RHEL, and SLES Reserved Instances.

### Guaranteed Capacity

- If an Availability Zone is specified, EC2 reserves capacity matching the attributes of the RI. The capacity reservation of an RI is automatically utilized by running instances matching these attributes.

### Payment Options

- All up front
  - Biggest discount
  - Full payment is made at the start of the term, with no other costs incurred for the remainder of the term, regardless of hours used.
- Partial up front
  - A portion of the cost must be paid upfront and the remaining hours in the term are billed at a discounted hourly rate, regardless of usage.
- No up front
  - You are billed a discounted hourly rate for every hour within the term, regardless of usage, and no upfront payment is required.

### Billing

- With per-second billing for EC2 instances you can launch, use, and terminate multiple instances within an hour and get the Reserved Instance Benefit for all of the instances. This includes Windows Server, SQL Server, and open source Linux.
  - <https://aws.amazon.com/about-aws/whats-new/2021/06/announcing-per-second-billing-for-ec2-windows-server-and-sql-server-instances/>
- Reserved Instances are billed for every clock-hour during the term that you select, regardless of whether an instance is running or not.
  - <https://docs.aws.amazon.com/AWSEC2/latest/UserGuide/concepts-reserved-instances-application.html>
- Reserved Instance billing benefits can be applied to a running instance on a per second basis.
- Rebooting an instance doesn't start a new instance billing period (with a minimum one-minute charge), unlike stopping and starting your instance. If an instance is stopped then started again, you stop incurring charges for an instance as soon as its state changes to stopping. Each time an instance transitions from stopped to running, a new instance billing period is started, billing a minimum of one minute every time you start your instance.
  - <https://docs.aws.amazon.com/AWSEC2/latest/UserGuide/ec2-instance-lifecycle.html#lifecycle-differences>

### Consolidated Billing

- You cannot control which instances are billed at the discounted rate
- If you leverage Consolidated Billing, AWS will use the aggregate total list price of active RIs across all of your consolidated accounts to determine which volume discount tier to apply.
  - Additional savings begin at \$500k
  - Convertible RIs do not receive volume discounts however the value of each Convertible RI that you purchase contributes to your volume discount tier standing.
- Reserved Instances are first applied to usage within the purchasing account, followed by qualifying usage in any other account in the organization. The Reserved Instance discount is applied to qualifying usage that is detected first by the AWS billing system.
- In general, Reserved Instances that are owned by an account are applied first to usage in that account. However, if there are qualifying, unused zonal Reserved Instances in other accounts in the organization, they are applied to the account before regional Reserved Instances owned by the account.

### Reserved Instance Marketplace

- The Reserved Instance Marketplace is an online marketplace that provides AWS customers the flexibility to sell their Amazon Elastic Compute Cloud (Amazon EC2) Reserved Instances to other businesses and organizations.

### General Recommendations

1. No up front cost purchase type
2. Regional
3. Standard RI (assuming your needs won't change that much)

### Documentation

<https://docs.aws.amazon.com/AWSEC2/latest/UserGuide/ec2-reserved-instances.html>