



Evaluate downgrading Oracle databases to Standard Edition 2 on AWS

AWS Prescriptive Guidance



AWS Prescriptive Guidance: Evaluate downgrading Oracle databases to Standard Edition 2 on AWS

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This document provides guidance for reducing your Oracle licensing costs by downgrading from Oracle Database Enterprise Edition (EE) to Oracle Database Standard Edition 2 (SE2). By following this guide, you can perform an in-depth assessment of your Enterprise Edition Oracle databases. You can then determine which databases can be safely downgraded to Standard Edition 2 during migration to [Amazon Relational Database Service \(Amazon RDS\) for Oracle](#). This guide also applies if you are already running Amazon RDS for Oracle Database EE and you want to downgrade to Oracle Database SE2.

Overview

Oracle Database EE is the default deployment option for production workloads in many organizations. This might be partly to the result of a common misconception that the Oracle Database SE2 is not capable of supporting enterprise-class applications. Both the Enterprise Edition and the Standard Edition 2 Oracle databases share a common code base, so technically they offer similar functionalities.

Oracle Database EE offers additional options, but it's significantly more expensive than Oracle Database SE2. Downgrading to Oracle Database SE2 gives you an opportunity to reduce the overall total cost of ownership of your databases. Applications with no or minimum usage of Enterprise Edition features are good candidates for downgrades to Oracle Database SE2.

This guide does not provide licensing advice. For specific licensing information, consult your own Oracle license agreements. You can engage specialized [AWS Oracle Competency Partners](#) that have helped many AWS customers interpret Oracle licensing and proceed with their migration.

Targeted business outcomes

By using this guide, you can derive the following business outcomes:

- **Cost savings on Oracle database licensing fees** – Downgrading to Standard Edition 2 reduces the total cost of running your applications.
- **Reduced need for significant upfront costs** – Amazon RDS for Oracle offers the License Included option so that you pay only for what you use.
- **Efficient assessment** – You can perform a bulk assessment of your databases to determine suitability for a downgrade to Standard Edition 2

Prerequisites and limitations

Prerequisites

- No application support requirements for Oracle Database Enterprise Edition (EE)
- Oracle Database EE running in an on-premises data center, or on [Amazon Elastic Compute Cloud \(Amazon EC2\)](#), or on Amazon RDS for Oracle or Amazon RDS Custom for Oracle
- A database client tool, such as Oracle SQL Developer or SQL*Plus, for running SQL commands
- Access to the database and [privileges](#) to run an [AWS Schema Conversion Tool \(AWS SCT\)](#) assessment

Limitations

- Amazon RDS for Oracle has storage size and IOPs limits. For the current maximum, see the [AWS documentation](#).
- Oracle Standard Edition 2 supports a maximum of 16 CPU threads. For currently supported instance classes for Amazon RDS for Oracle Standard Edition 2, see the [AWS documentation](#).
- AWS SCT supports Oracle 10.2 and later.

Product versions

The general logic described in this guide applies to Oracle versions from 9i and later. However, AWS SCT supports only Oracle Database versions 10g and later. To identify feature usage in cases where AWS SCT is not supported, run SQL queries on the source database.

For a current list of supported versions and editions, see [Oracle on Amazon RDS](#) in the AWS documentation. For details on pricing and supported instance classes, see [Amazon RDS for Oracle pricing](#).

AWS services and other tools

- [Amazon Relational Database Service \(Amazon RDS\) for Oracle](#) helps you set up, operate, and scale an Oracle relational database in the AWS Cloud.
- [AWS Schema Conversion Tool \(AWS SCT\)](#) supports heterogeneous database migrations by automatically converting the source database schema and a majority of the custom code to a format that's compatible with the target database. You can use AWS SCT to assess, convert, and copy the database schema of your source Oracle database into a format compatible with Amazon RDS for Oracle. Using AWS SCT, you can analyze the potential cost savings that you can achieve by changing your license type from Oracle Database Enterprise Edition to Oracle Database Standard Edition 2.
- [Oracle SQL Developer](#) is an integrated development environment that simplifies the development and management of Oracle databases in both traditional and cloud-based deployments.
- [SQL*Plus](#) is an interactive tool for running SQL commands on an Oracle database.

If you are working with an AWS consulting team, ask about in-house tooling and scripting built by AWS database specialists. These tools and scripts can help with gathering and reviewing data dictionary information (such as the `DBA_FEATURE_USAGE_STATISTICS` view and the count of bitmap indexes).

Assessing your environment

To assess your Oracle database and find out whether Enterprise Edition features are being used, you can use one of the following approaches:

- SQL commands
- The license-evaluation feature of AWS SCT

Assessing Oracle Database Enterprise Edition by using SQL commands

Oracle tracks the usage of Oracle Database options, Oracle management packs, and their corresponding features in a view called [DBA_FEATURE_USAGE_STATISTICS](#). The view is updated once a week by default, so it might take 7 days to show recent usage data. To get the latest information, manually refresh the view using the DBMS_FEATURE_USAGE_INTERNAL package. Your database user requires EXECUTE privilege on DBMS_FEATURE_USAGE_INTERNAL to refresh the view, and SELECT ANY DICTIONARY privilege to query the view.

Oracle provides the script `options_packs_usage_statistics.sql` in [Support document 1317265.1](#). You can use that script to check which options, features, and management packs have been used in the database. Alternatively, you can run the following query to list previously used options and features.

```
-- To view the last refresh date of DBA_FEATURE_USAGE_STATISTICS
select max(last_sample_date) from dba_feature_usage_statistics order by 1;

-- To manually refresh DBA_FEATURE_USAGE_STATISTICS view
exec sys.dbms_feature_usage_internal.exec_db_usage_sampling(sysdate);

-- To list features and options in use
select dbafus1.name, dbafus1.detected_usages, dbafus1.currently_used,
       dbafus1.first_usage_date, dbafus1.last_usage_date, dbafus1.version
from dba_feature_usage_statistics dbafus1
where dbafus1.version = (select max(dbafus2.version)
                        from dba_feature_usage_statistics dbafus2
                        where dbafus2.name = dbafus1.name)
and dbafus1.detected_usages > 0
and dbafus1.dbid = (select dbid from v$database)
```

```
and dbafus1.currently_used='TRUE'
order by dbafus1.name;

-- To check use of parallelism for activities like DMLs, DDLs, index builds, statistics
  gathering, Data Pump
select name, value
from gv$sysstat
where
    upper(NAME) like '%PARALLEL OPERATIONS%'
OR
    upper(NAME) like '%PARALLELIZED%'
OR
    upper(NAME) like '%PX%';

-- To identify use of Materialized Views Query Rewrite
select owner, mview_name from dba_mviews
where owner not like '%SYS%'
and rewrite_enabled='Y';

-- To identify bitmap indexes
select * from dba_indexes
where index_type='BITMAP'
and owner not like '%SYS%';

-- To identify non-system use of Partitioning
select * from dba_tab_partitions where table_owner not like '%SYS%';
```

Review the result of the previous query and compare it with [Oracle documentation](#). Investigate each Enterprise Edition feature or option listed in the output to understand their use case and determine appropriate alternatives in Oracle Database Standard Edition 2 where possible.

Assessing Oracle Database Enterprise Edition by using AWS SCT

AWS Schema Conversion Tool (AWS SCT) provides a project-based user interface for assessing, converting, and copying the database schema of your source Oracle database into a format that is compatible with Amazon RDS for Oracle. Using AWS SCT, you can analyze potential cost savings that can be achieved by changing your Oracle Database license type from Enterprise Edition to Standard Edition 2.

The *License evaluation and cloud support* section of the AWS SCT report provides detailed information about Oracle database features in use. This information can help you make informed

decisions while migrating to Amazon RDS for Oracle. For example, the report might say that your Enterprise Edition server uses the Compression feature, and that you must remove dependencies on ColumnStoreIndex and Partitioning. It also lists features, such as InMemoryOLTP, that can't be moved to Amazon RDS for Oracle.

Scaling the Oracle assessment

To evaluate multiple servers, you can run batch assessments with AWS SCT by using the [multiserver assessor](#) option. After assessing each schema, the assessor produces a server-level report that includes the *License evaluation and cloud support* section.

Comparing Oracle Database EE and SE2 features

The following table is a short version of the list of Oracle Database Enterprise Edition (EE) features and possible alternatives in Amazon RDS for Oracle Standard Edition 2 (SE2). For a comprehensive list, see the [Oracle documentation](#).

Functional area	Feature or option	EE	SE2	Notes
High availability	Oracle Data Guard (extra cost)	Yes	No	The Multi-AZ (Availability Zone) feature of Amazon RDS replicates database updates across two Availability Zones to increase durability and availability. Amazon RDS will automatically fail over to the standby for planned maintenance and unplanned disruptions.
High availability	Oracle Active Data Guard	Yes	No	You can serve read-only traffic from a replica database instance by using the change

				data capture (CDC) feature of AWS Database Migration Service (AWS DMS) to replicate changes from your Amazon RDS for Oracle SE2 instance.
High availability	Oracle Real Application Clusters (RAC) One Node (extra cost)	Yes	No	The Amazon RDS Multi-AZ feature applies.

High availability	Rolling upgrades —patch set, database, and operating system	Yes	No	For database software upgrades in Multi-AZ deployments , Amazon RDS simultaneously upgrades both the primary and standby database. For operating system (OS) upgrades in Multi-AZ deployments, Amazon RDS upgrades the standby instance first. It then fails over the primary to the standby before upgrading the primary instance. This reduces the downtime window for OS upgrades.
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High availability	Block change tracking for fast incremental backup	Yes	No	With Amazon RDS backups , the first snapshot of your DB instance is a full copy. Subsequent backups are incremental backups of blocks that have changed since the last full backup. You can restore your Amazon RDS for Oracle database instance from automated or manual snapshots.
High availability	Parallel backup and recovery	Yes	No	
High availability	FLASHBACK DATABASE command	Yes	No	You can restore your DB instance to any specific time during the backup retention period by using the point-in-time recovery feature of Amazon RDS.

High availability	Online index rebuild	Yes	No	Where possible, plan for these activities during a downtime window.
High availability	Online table organization	Yes	No	
High availability	Online table redefinition	Yes	No	
High availability	Online datafile move	Yes	No	
Manageability	Automatic Workload Repository (AWR)	Yes	No	You can use Oracle Statspack, an option pack in Oracle SE2, in place of Oracle AWR. Amazon RDS Performance Insights is a database performance monitoring and tuning tool built for the cloud. You can use the tool dashboard to detect performance problems by evaluating top waits, top SQL statements, top hosts, and top users.

Manageability	SQL plan management	Yes	Yes	You can use stored outlines, hints, and SQL plan baselines to tune your queries in Amazon RDS for Oracle SE2.
Scalability	CPU restrictions	No	Yes	SE2 is capped at a maximum of two CPU sockets. Each SE2 database is automatically capped to use a maximum of 16 concurrent user threads.

Scalability	Oracle Real Application Clusters (RAC) (extra cost)	Yes	No	You can scale your Amazon RDS for Oracle SE2 instance vertically to address the growing demands of an application. There is minimal downtime when you are scaling up in a Multi-AZ environment. The standby database gets upgraded first, then a failover will occur to the newly sized database. When you scale up in a Single-AZ environment, the instance will be unavailable during the scale operation.
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Security	Column-level and tablespace encryption	Yes	No	Amazon RDS can encrypt your Amazon RDS DB instances . Data that is encrypted at rest includes the underlying storage for DB instances, its automated backups, read replicas, and snapshots.
Snapshots and cloning	Storage Snapshot Optimization	Yes	No	Amazon RDS supports user-initiated snapshot creation. For more information, see Amazon RDS backup and restore .

Data warehousing	Oracle Partitioning	Yes	No	Depending on your specific use case, you can implement a partitioning feature for tables in Oracle Database SE2 by using a single view accessing multiple subtables and the INSTEAD OF trigger. For more information, see the AWS Database blog post Implementing table partitioning in Oracle Standard Edition: Part 1 .
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Best practices

We recommend the following best practices for assessing and downgrading your Oracle Database Enterprise Edition (EE) to Standard Edition 2 (SE2) on Amazon RDS for Oracle.

- **Validate vendor support for Oracle Database SE2** – Confirm that your application is certified to run on Oracle Database SE2. Check directly with the software vendor or their documentation. Downgrading to Oracle Database SE2 without vendor confirmation might invalidate support for an application.
- **Identify the use of Oracle Database EE features for administration activities** – Database or application administrators sometimes rely on Oracle Database EE features to improve operational processes. Examples include online maintenance activities, such as index rebuild, and table move, and parallelism for maintenance activities. Identify usage of such features and make an informed decision. You can modify your operations or apply workarounds where possible to mitigate the loss of Oracle Database EE features.
- **Assess workload patterns of the database** – Oracle Database SE2 automatically restricts usage to a maximum of 16 CPU threads. Analyze your database workload pattern to determine whether the 16 CPU thread limit will negatively impact service levels when you downgrade to Oracle Database SE2. You can use tools such as the Automatic Workload Repository (AWR) reports, "DBA_HIST_*" views, and server-level metrics for this analysis. For more information about the available instance class for Oracle Database SE2, see the [Amazon RDS for Oracle documentation](#).
- **Test your workload against Oracle Database SE2** – Run multiple tests using a representative workload to determine whether the 16-thread limit imposed by Oracle Database SE2 has any negative impact on your workload. Monitor results and tune the database as required.
- **Test database administration activities** – Test activities such as monitoring, performance assessments, tuning, and maintenance tasks to build comfort levels around new ways of working in the Oracle Database SE2 environment.
- **Test the migration process** – Run end-to-end migration tests to build operator confidence, fine-tune the approach, and document every issue and its resolution.

FAQ

How can I migrate from Oracle Database EE to Oracle Database SE2?

Migrating from Oracle Database EE to Oracle Database SE2 requires logical export of data from the Enterprise Edition database and import of the data into the Standard Edition 2 database instance. Use tools such as [Oracle Export/Import](#), [Oracle Data Pump](#), or [Oracle GoldenGate](#) or [AWS Database Migration Service \(AWS DMS\)](#) full load and change data capture (CDC) for reduced downtime.

How can I downgrade my EE Oracle database to SE2 with minimum downtime?

To reduce overall downtime, you can bulk load data into your SE2 database using Oracle Export/Import. You can use logical replication tools such as AWS DMS or Oracle GoldenGate to synchronize your SE2 database.

Can I have High Availability in my Amazon RDS for Oracle SE2 database?

Amazon RDS currently uses synchronous replication technology and automatic failover functionality to provide [Multi-AZ](#) deployments for Oracle DB instances. Multi-AZ deployments are available for all Oracle database editions supported by Amazon RDS.

How can I monitor the performance of my Amazon RDS for Oracle SE2 database instance?

You can monitor your SE2 database instance using [Amazon RDS Performance Insights](#), [Enhanced Monitoring](#), and [Amazon CloudWatch](#). You can also analyze database performance using Oracle Statspack in place of Oracle Automatic Workload Repository (AWR).

Can I have encryption on my Amazon RDS for Oracle SE2 database instance?

Amazon RDS can [encrypt your Amazon RDS DB instances](#). Data that is encrypted at rest includes the underlying storage for DB instances, its automated backups, read replicas, and snapshots. To turn on encryption in transit using [SSL encryption](#) for an Oracle DB instance, add the Oracle SSL option to the option group associated with the Oracle DB instance.

What types of licensing options are available with Amazon RDS for Oracle?

There are two types of licensing options available for using Amazon RDS for Oracle:

- **Bring Your Own License (BYOL)** – In this licensing model, you can use your existing Oracle Database licenses to run Oracle deployments on Amazon RDS. To run a DB instance under the BYOL model, you must have the appropriate Oracle Database license (with Software Update License and Support) for the DB instance class and Oracle Database edition that you want to run. You must also follow Oracle's [licensing policies](#) for Oracle Database software in the Amazon EC2 cloud computing environment. DB instances reside in the Amazon EC2 environment.
- **License Included** – In the License Included service model, you do not need separately purchased Oracle licenses. The Oracle Database software has been licensed by AWS for your use subject to Section 10.3.1 of the [AWS Service Terms](#). License Included pricing is inclusive of software, underlying hardware resources, and Amazon RDS management capabilities.

Which Oracle Database editions are available with Amazon RDS for Oracle?

Amazon RDS currently supports the following Oracle Database editions under each of the licensing models:

- **BYOL** – Enterprise Edition (EE), Standard Edition 2 (SE2)
- **License Included** – Standard Edition 2 (SE2)

What are the licensing policies for using Amazon RDS for Oracle?

- **BYOL** – To run a DB instance under the BYOL model, you must have the appropriate Oracle Database license (with Software Update License and Support) for the DB instance class and Oracle Database edition you want to run. You must also follow Oracle's [licensing policies](#) for Oracle Database software in the Amazon EC2 cloud computing environment. DB instances reside in the Amazon EC2 environment.
- **License Included** – In the License Included service model, you do not need separately purchased Oracle licenses. The Oracle Database software has been licensed by AWS for your use subject to Section 10.3.1 of the [AWS Service Terms](#). License Included pricing is inclusive of software, underlying hardware resources, and Amazon RDS management capabilities.

How is Amazon RDS for Oracle supported?

- **BYOL** – Under this model, you continue to use your active Oracle support account and contact Oracle directly for Oracle Database specific service requests. If you have an active AWS Support account, you can contact AWS Support for Amazon RDS specific issues. Amazon Web Services and Oracle have a multiple-vendor support process for cases that require assistance from both organizations.
- **License Included** – In this model, if you have an active AWS Support account, you should contact AWS Support for both Amazon RDS and Oracle Database specific service requests.

How does the license option affect DB instance scaling?

- **BYOL** – You can scale your DB instances in accordance with the terms of your Oracle licenses.
- **License Included** – DB instances that are running Oracle can be scaled up and down at any point, subject to the prevailing hourly pricing for each DB instance class.

For more information on the scaling implications of Reserved DB instances, see [Reserved DB instances for Amazon RDS](#).

How does the license option affect version upgrades?

- **BYOL** – To use Amazon RDS for Oracle, you should have Software Update License and Support from Oracle.
- **License Included** – The cost of the Software Update License is embedded in the hourly price, enabling access to Oracle Database software updates.

Can I change the licensing option for my DB instance (for example, from BYOL to License Included)?

Yes, you can change your license options through the AWS Command Line Interface (AWS CLI) or through the AWS Management Console. On the Console, choose **Modify Instance**, and select the appropriate option in the **Licensing Model** dropdown list.

Next steps

After you determine that you can safely downgrade a database to Oracle Database Standard Edition 2 (SE2) on Amazon RDS for Oracle, you can migrate the database by using one or a combination of the following tools:

- Oracle import and export utilities can move Oracle data in and out of Oracle databases. Oracle offers two types of database import and export utilities: Oracle Export and Import (for earlier releases) and Oracle Data Pump (available in Oracle Database 10g and later).
- Oracle GoldenGate offers real-time replication capabilities so that you can synchronize your target database after an initial load. This option can help reduce application downtime during go-live.
- AWS Database Migration Service (AWS DMS) helps you migrate relational databases, data warehouses, NoSQL databases, and other types of data stores. You can use AWS DMS to migrate your data into the AWS Cloud, between on-premises instances (through an AWS Cloud setup), or between combinations of cloud and on-premises databases. The change data capture (CDC) option of AWS DMS offers continuous replication, so that you can reduce the total downtime during migration. For information about the Oracle database versions and editions that AWS DMS supports, see the [AWS DMS documentation](#).

Depending on your availability requirements during the downgrade, you can adopt any of the following options to safely downgrade your Enterprise Edition database to Standard Edition 2 on Amazon RDS for Oracle.

Downgrading with downtime

- Use Oracle Data Pump to create consistent export of data from the Enterprise Edition database and import that data into the Standard Edition 2 database. For more information, see [Step by Step Procedure to Convert from Enterprise Edition to Standard Edition \(Doc ID 465189.1\)](#). Oracle credentials are required.
- Use AWS DMS to perform a full load of data from the Enterprise Edition database to the Standard Edition 2 database.
- Use Oracle GoldenGate to perform a full instantiation of the Standard Edition 2 database from the Enterprise Edition database.

Downgrading with reduced downtime

- Use Oracle Data Pump for consistent export and import of the initial load, and use AWS DMS CDC for data synchronization.
- Use Oracle Data Pump for consistent export and import of the initial load, and use Oracle GoldenGate for data synchronization.
- Use AWS DMS for the full load and for data synchronization.
- Use Oracle GoldenGate for full instantiation and for data synchronization.

For more information on migrating Oracle databases to Amazon RDS for Oracle, see the following AWS Prescriptive Guidance documentation:

- [Migrating Oracle databases to the AWS Cloud](#) (guide)
- [Migrate an Oracle database from Amazon EC2 to Amazon RDS for Oracle using AWS DMS](#) (pattern)
- [Migrate an on-premises Oracle database to Amazon RDS for Oracle using Oracle Data Pump](#) (pattern)

Resources

AWS references

- [Amazon RDS for Oracle](#)
- [Amazon RDS for Oracle pricing](#)
- [Amazon RDS documentation](#)
- [Amazon EC2](#)
- [AWS DMS documentation](#)
- [AWS SCT documentation](#)
- [AWS Service Terms](#)
- [Analyzing performance management in Oracle SE using Amazon RDS for Oracle](#) (blog post)
- [Managing your SQL plan in Oracle SE with Amazon RDS for Oracle](#) (blog post)
- [Implementing table partitioning in Oracle Standard Edition: Part 1](#) (blog post)
- [Migrating Oracle databases to the AWS Cloud](#) (guide)
- [Migrate an Oracle database from Amazon EC2 to Amazon RDS for Oracle using AWS DMS](#) (pattern)
- [Migrate an on-premises Oracle database to Amazon RDS for Oracle using Oracle Data Pump](#) (pattern)

Oracle references

- [Oracle Licensing Information](#)
- [Step by Step Procedure to Convert from Enterprise Edition to Standard Edition \(Doc ID 465189.1\)](#), Oracle login required
- [Database Options/Management Packs Usage Reporting for Oracle Databases 11.2 and later \(Doc ID 1317265.1\)](#), Oracle login required

Video

- [Best Practices for Running Oracle Databases on Amazon RDS](#)

AWS Partners

- [AWS Oracle Competency Partners](#)

Document history

The following table describes significant changes to this guide. If you want to be notified about future updates, you can subscribe to an [RSS feed](#).

Change	Description	Date
Multiple updates	On the Prerequisites page, Amazon RDS Custom for Oracle was added as a source option. On the AWS tools and other services page, information was added about AWS-developed tooling and scripts.	October 24, 2023
Initial publication	—	June 30, 2022