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Data Concurrency and Consistency

This chapter explains how Oracle Database maintains consistent data in a multiuser database environment.

This chapter contains the following sections:

Introduction to Data Concurrency and Consistency

In a single-user database, a user can modify data without concern for other users modifying the same data at the same time. However, in a multiuser database, statements within multiple simultaneous transactions may update the same data. Transactions executing simultaneously must produce meaningful and consistent results.

A multiuser database must provide the following:

- The assurance that users can access data at the same time (data concurrency)
- The assurance that each user sees a consistent view of the data (data consistency), including visible changes made by the user's own transactions and committed transactions of other users

To describe consistent transaction behavior when transactions run concurrently, database researchers have defined a transaction isolation model called serializability. A serializable transaction operates in an environment that makes it appear as if no other users were modifying data in the database.

While this degree of isolation between transactions is generally desirable, running many applications in serializable mode can seriously compromise application throughput. Complete isolation of concurrently running transactions could mean that one transaction cannot perform an insertion into a table being queried by another transaction. In short, real-world considerations usually require a compromise between perfect transaction isolation and performance.

Oracle Database maintains data consistency by using a multiversion consistency model and various types of locks and transactions. In this way, the database can present a view of data to multiple concurrent users, with each view consistent to a point in time. Because different versions of data blocks can exist simultaneously, transactions can read the version of data committed at the point in time required by a query and return results that are consistent to a single point in time.

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> **See Also:**
>
> "Data Integrity" and "Transactions "

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Multiversion Read Consistency

In Oracle Database, multiversioning is the ability to simultaneously materialize multiple versions of data. Oracle Database maintains multiversion read consistency.

Queries of an Oracle database have the following characteristics:

- Read-consistent queries

  The data returned by a query is committed and consistent for a single point in time.

> **Note:**
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> Oracle Database *never* permits a dirty read, which occurs when a transaction reads uncommitted data in another transaction.

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To illustrate the problem with dirty reads, suppose one transaction updates a column value without committing. A second transaction reads the updated and dirty (uncommitted) value. The first session rolls back the transaction so that the column has its old value, but the second transaction proceeds using the updated value, corrupting the database. Dirty reads compromise data integrity, violate foreign keys, and ignore unique constraints.

- Nonblocking queries

  Readers and writers of data do not block one another.

> **See Also:**
>
> "Summary of Locking Behavior"

Statement-Level Read Consistency

Oracle Database always enforces **statement-level read consistency**, which guarantees that data returned by a single query is committed and consistent for a single point in time.

The point in time to which a single SQL statement is consistent depends on the transaction isolation level and the nature of the query:

- In the read committed isolation level, this point is the time at which the *statement* was opened. For example, if a `SELECT` statement opens at SCN 1000, then this statement is consistent to SCN 1000.