

# Oracle Data Guard Protection Modes

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Oracle Data Guard provides three distinct modes of data protection.

Oracle Data Guard provides three protection modes: maximum availability, maximum performance, and maximum protection.

In some situations, a business cannot afford to lose data regardless of the circumstances. In other situations, the availability of the database may be more important than any potential data loss in the unlikely event of a multiple failure. Finally, some applications require maximum database performance at all times, and can therefore tolerate a small amount of data loss if any component fails. The following are brief descriptions of the protection modes available for each of these situations:

### Maximum Protection

This protection mode ensures that no data loss occurs if the primary database fails. To provide this level of protection, the redo data needed to recover a transaction must be written to both the online redo log and to the standby redo log on at least one synchronized standby database before the transaction commits. To ensure that data loss cannot occur, the primary database shuts down, rather than continue processing transactions, if it cannot write its redo stream to at least one synchronized standby database.

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Maximum protection is similar to maximum availability but provides an additional level of data protection in the event of multiple failure events. Unlike maximum availability, which allows the primary to continue processing if it is unable to receive acknowledgement from a standby database, maximum protection shuts the primary database down rather than allowing it to continue processing transactions that are unprotected.

Because this data protection mode prioritizes data protection over primary database availability, Oracle recommends that a minimum of two standby databases be used to protect a primary database that runs in maximum protection mode to prevent a single standby database failure from causing the primary database to shut down.

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All three protection modes require that specific redo transport options be used to send redo data to at least one standby database.

### Maximum Availability

This protection mode provides the highest level of data protection that is possible without compromising the availability of a primary database. With Oracle Data Guard, transactions do not commit until all redo data needed to recover those transactions has either been received in memory or written to the standby redo log (depending upon

configuration) on at least one synchronized standby database. If the primary database cannot write its redo stream to at least one synchronized standby database, it operates as if it were in maximum performance mode to preserve primary database availability until it is again able to write its redo stream to a synchronized standby database.

This protection mode ensures zero data loss except in the case of certain double faults, such as failure of a primary database after failure of the standby database.

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This protection mode provides the highest level of data protection that is possible without compromising the availability of a primary database. Under normal operations, transactions do not commit until all redo data needed to recover those transactions has been written to the online redo log AND based on user configuration, one of the following is true:

- redo has been received at the standby, I/O to the standby redo log has been initiated, and acknowledgement sent back to primary
- redo has been received and written to standby redo log at the standby and acknowledgement sent back to primary

If the primary does not receive acknowledgement from at least one synchronized standby, then it operates as if it were in maximum performance mode to preserve primary database availability until it is again able to write its redo stream to a synchronized standby database.

If the primary database fails, then this mode ensures no data loss occurs provided there is at least one synchronized standby in the Oracle Data Guard configuration.

Transactions on the primary are considered protected as soon as Oracle Data Guard has written the redo data to persistent storage in a standby redo log file. Once that is done, acknowledgment is quickly made back to the primary database so that it can proceed to the next transaction. This minimizes the impact of synchronous transport on primary database throughput and response time. To fully benefit from complete Oracle Data Guard validation at the standby database, be sure to operate in real-time apply mode so that redo changes are applied to the standby database as fast as they are received. Oracle Data Guard signals any corruptions that are detected so that immediate corrective action can be taken.

## **Performance Versus Protection in Maximum Availability Mode**

When you use Maximum Availability mode, it is important to understand the possible results of using the LOG\_ARCHIVE\_DEST\_# attributes SYNC/AFFIRM versus SYNC/NOAFFIRM (FastSync) so that you can make the choice best suited to your needs.

When a transport is performed using SYNC/AFFIRM, the primary performs write operations and waits for acknowledgment that the redo has been transmitted synchronously to the physical standby and written to disk.

A SYNC/AFFIRM transport provides an additional protection benefit at the expense of a performance impact caused by the time required to complete the I/O to the standby redo log.

When a transport is performed using SYNC/NOAFFIRM, the primary performs write operations and waits only for acknowledgement that the data has been received on the standby, *not* that it has been written to disk. The SYNC/NOAFFIRM transport can provide a performance benefit at the expense of potential exposure to data loss in a special case of multiple simultaneous failures.

With those definitions in mind, suppose you experience a catastrophic failure at the primary site at the same time that power is lost at the standby site. Whether data is lost depends on the transport mode being used. In the case of SYNC/AFFIRM, in which there is a check to confirm that data is written to disk on the standby, there would be no data loss because the data would be available on the standby when the system was recovered. In the case of SYNC/NOAFFIRM, in which there is no check that data has been written to disk on the standby, there may be some data loss.

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## Maximum Performance

This is the default protection mode. It provides the highest level of data protection that is possible without affecting the performance of a primary database. This is accomplished by allowing transactions to commit as soon as all redo data generated by those transactions has been written to the online log. Redo data is also written to one or more standby databases, but this is done asynchronously with respect to transaction commitment, so primary database performance is unaffected by delays in writing redo data to the standby database(s).

This protection mode offers slightly less data protection than maximum availability mode and has minimal impact on primary database performance.

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## Setting the Data Protection Mode of a Primary Database

Protection mode settings can be set and changed on an open database as long as the configuration meets the requirements of the protection mode (including going from maximum performance mode to maximum availability mode).

Perform the following steps to set the data protection mode of a primary database:

1. Select a data protection mode that meets your availability, performance, and data protection requirements.
2. Verify that at least one standby database meets the redo transport requirements for the desired data protection mode.

The `LOG_ARCHIVE_DEST_n` database initialization parameter that corresponds to at least one standby database must include the redo transport attributes listed in the following table for the desired data protection mode.

The standby database must also have a standby redo log.

### Required Redo Transport Attributes for Data Protection Modes

Maximum Availability	Maximum Performance	Maximum Protection
AFFIRM or NOAFFIRM	NOAFFIRM	AFFIRM
SYNC	ASYNC	SYNC
DB_UNIQUE_NAME	DB_UNIQUE_NAME	DB_UNIQUE_NAME

3. Verify that the `DB_UNIQUE_NAME` database initialization parameter has been set to a unique value on the primary database and on each standby database.
4. Verify that the `LOG_ARCHIVE_CONFIG` database initialization parameter has been defined on the primary database and on each standby database, and that its value includes a `DG_CONFIG` list that includes the `DB_UNIQUE_NAME` of the primary database and each standby database.

The following sample SQL statement configures the `LOG_ARCHIVE_CONFIG` parameter:

```
SQL> ALTER SYSTEM SET
LOG_ARCHIVE_CONFIG='DG_CONFIG=(CHICAGO,BOSTON)';
```

5. Set the data protection mode by executing the following SQL statement on the primary database:

```
SQL> ALTER DATABASE SET STANDBY DATABASE TO MAXIMIZE {AVAILABILITY |  
PERFORMANCE | PROTECTION};
```

The data protection mode can be set to **MAXIMUM PROTECTION** on an open database only if the current data protection mode is **MAXIMUM AVAILABILITY** and if there is at least one synchronized standby database.

6. Perform the following query on the primary database to confirm that it is operating in the new protection mode:

```
SQL> SELECT PROTECTION_MODE FROM V$DATABASE;
```