

# ADO.NET in C#.NET

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(Communication between .net applications and databases)

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## Introduction to ADO.NET

ADO.NET (ActiveX Data Objects for .NET) is a data access technology in the .NET framework that enables communication between applications and databases. It provides a set of classes to interact with various data sources such as SQL Server, Oracle, and MySQL.

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## Features of ADO.NET

- **Disconnected Data Access:** Uses `DataSet` to store data independently of the database.
  - **Scalability:** Efficient for large applications as it supports connection pooling.
  - **Interoperability:** Works with different database systems using providers.
  - **Security:** Provides secure data access through connection authentication.
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## ADO.NET Architecture

ADO.NET consists of two major components:

1. **Connected Architecture** (Using `DataReader`)
    - Works with `SqlConnection`, `SqlCommand`, `SqlDataReader`
    - Requires an active connection to the database
    - Fast and forward-only data retrieval
  2. **Disconnected Architecture** (Using `DataSet`)
    - Uses `SqlDataAdapter`, `DataSet`, `DataTable`
    - Stores data in memory for offline processing
    - Useful for manipulating data without keeping the database connection open
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## Important ADO.NET Classes (Connected Architecture)

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### Namespace : Microsoft.Data.SqlClient

1. **SqlConnection:** Establishes a connection to the database.

```
SqlConnection conn = new SqlConnection("your_connection_string");  
conn.Open();
```

2. **SqlCommand**: Executes SQL queries and stored procedures.

```
SqlCommand cmd = new SqlCommand("SELECT * FROM Students", conn);
```

**Note:** Install *Microsoft.Data.SqlClient* package using NuGet Package Manager.

3. **SqlDataReader**: Reads data in a forward-only manner (Connected Mode).

```
SqlConnection conn = new SqlConnection("your_connection_string");

SqlCommand cmd = new SqlCommand("SELECT * FROM Students", conn);

conn.Open();

SqlDataReader reader = cmd.ExecuteReader();

while(reader.Read())
{
    Console.WriteLine(reader["StudentName"].ToString());
}
```

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## Executing Queries in ADO.NET

1. **Executing Non-Query (Insert, Update, Delete)**

```
SqlCommand cmd = new SqlCommand("INSERT INTO Students (Name, Age) VALUES ('John', 20)", con);
int rowsAffected = cmd.ExecuteNonQuery();
```

2. **Executing Scalar Query (Single Value)**

```
SqlCommand cmd = new SqlCommand("SELECT COUNT(*) FROM Students", con);
int count = (int)cmd.ExecuteScalar();
```

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## Perform CRUD Operations

Create (INSERT Operation)

```
SqlConnection con = new SqlConnection("your_connection_string");
string query = "INSERT INTO Students (Name, Age) VALUES (@Name, @Age)";
SqlCommand cmd = new SqlCommand(query, con);
cmd.Parameters.AddWithValue("@Name", "Alice");
cmd.Parameters.AddWithValue("@Age", 22);
cmd.ExecuteNonQuery();
```

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## Read

```
SqlConnection conn = new SqlConnection("your_connection_string");

SqlCommand cmd = new SqlCommand("SELECT * FROM Students", conn);

conn.Open();

SqlDataReader reader = cmd.ExecuteReader();

while(reader.Read())
{
    Console.WriteLine(reader["StudentName"].ToString());
}
```

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## UPDATE

```
SqlConnection conn = new SqlConnection("your_connection_string");

string query = "UPDATE Students SET Age = @Age WHERE Name = @Name";
SqlCommand cmd = new SqlCommand(query, con);
cmd.Parameters.AddWithValue("@Name", "Alice");
cmd.Parameters.AddWithValue("@Age", 23);

cmd.ExecuteNonQuery();
```

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## DELETE

```
SqlConnection conn = new SqlConnection("your_connection_string");
```

```
string query = "DELETE FROM Students WHERE Name = @Name";  
SqlCommand cmd = new SqlCommand(query, con);  
cmd.Parameters.AddWithValue("@Name", "Alice");  
  
cmd.ExecuteNonQuery();
```

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## Important ADO.NET Classes (Disconnected Architecture)

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1. **SqlDataAdapter**: Fills the **DataSet** with database data.

```
SqlDataAdapter da = new SqlDataAdapter("SELECT * FROM Students", con);  
DataSet ds = new DataSet();  
da.Fill(ds);
```

2. **DataSet**: Stores data in memory as a collection of **DataTable** objects.

```
DataTable dt = ds.Tables[0];
```

3. **DataTable**: Represents a single table of data.

```
foreach (DataRow row in dt.Rows) {  
    Console.WriteLine(row["StudentName"].ToString());  
}
```

**Note:** **DataSet** and **DataTable** belongs to **System.Data** namespace

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## Conclusion

- ADO.NET provides a flexible and efficient way to interact with databases in C#.NET applications.
- It supports both connected and disconnected models, making it suitable for various application scenarios.