EDB Postgres Advanced Server .NET Connector Guide

Version 4.1.6.1

Built at 2021-01-25T06:24:24

1 What's New

The following features are added to create EDB .NET Connector `4.1.6.1`:

- Merged with the upstream Npgsql driver version 4.1.6. For more information about the merge updates, visit https://www.nuget.org/packages/Npgsql/4.1.6.
- Support for .NET Framework 4.7.2 and .NET Framework 4.8.

2 Requirements Overview

The following section details the supported platforms for the EDB .NET Connector.

Supported Server Versions and Platforms

The EDB .NET Connector is certified with Advanced Server version 9.5 and above.

The EDB .NET Connector graphical installers are supported on the following Windows platforms:

64-bit Windows:

- Windows Server 2019
- Windows Server 2016
- Windows Server 2012 R2
- Windows 10
- Windows 8.1

32-bit Windows:

- Windows 10
- Windows 8.1

3 The EDB .NET Connector - Overview

The EDB .NET Connector is a .NET data provider that allows a client application to connect to a database stored on an Advanced Server host. The .NET Connector accesses the data directly, allowing the client application optimal performance, a broad spectrum of functionality, and access to Advanced Server features.

The .NET Connector supports following frameworks:

- .NET Framework versions 4.6.1, 4.7.2 and 4.8
- .NET Standard 2.0 and 2.1
- .NET Core 3.0
- Entity Framework 6
- EDB VSIX

The .NET Class Hierarchy

The .NET Class Hierarchy contains a number of classes that you can use to create objects that control a connection to the Advanced Server database and manipulate the data stored on the server. The following are just a few of the most commonly used object classes:

`EDBConnection`

> The `EDBConnection` class represents a connection to Advanced Server. An `EDBConnection` object contains a `ConnectionString` that instructs the .NET client how to connect to an Advanced Server database.

`EDBCommand`

> An `EDBCommand` object contains an SQL command that the client will execute against Advanced Server. Before you can execute an `EDBCommand` object, you must link it to an `EDBConnection` object.

`EDBDataReader`

> An `EDBDataReader` object provides a way to read an Advanced Server result set. You can use an `EDBDataReader` object to step through one row at a time, forward-only.

`EDBDataAdapter`

> An `EDBDataAdapter` object links a result set to the Advanced Server database. You can modify values and use the `EDBDataAdapter` class to update the data stored in an Advanced Server database.

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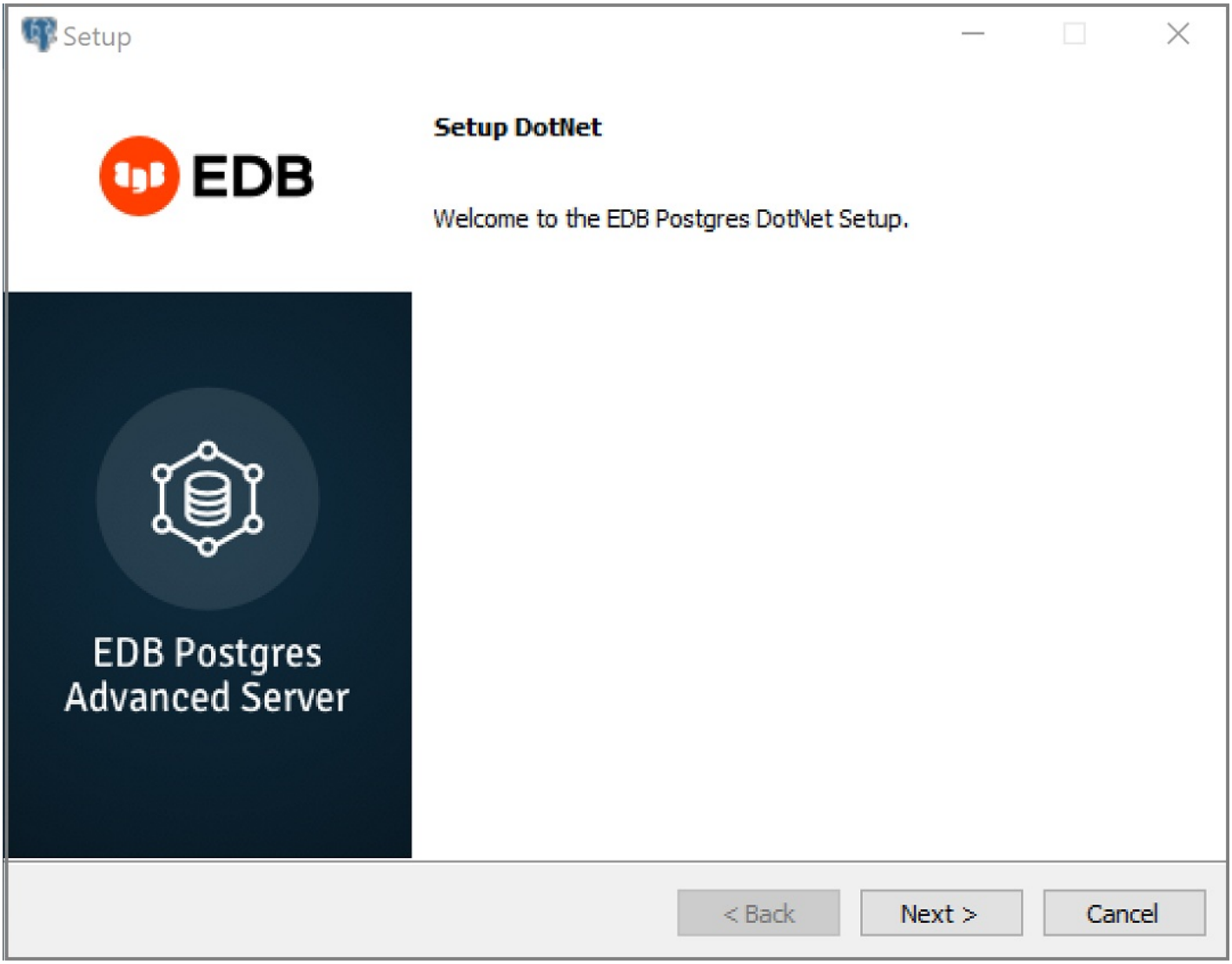
4 Installing and Configuring the .NET Connector

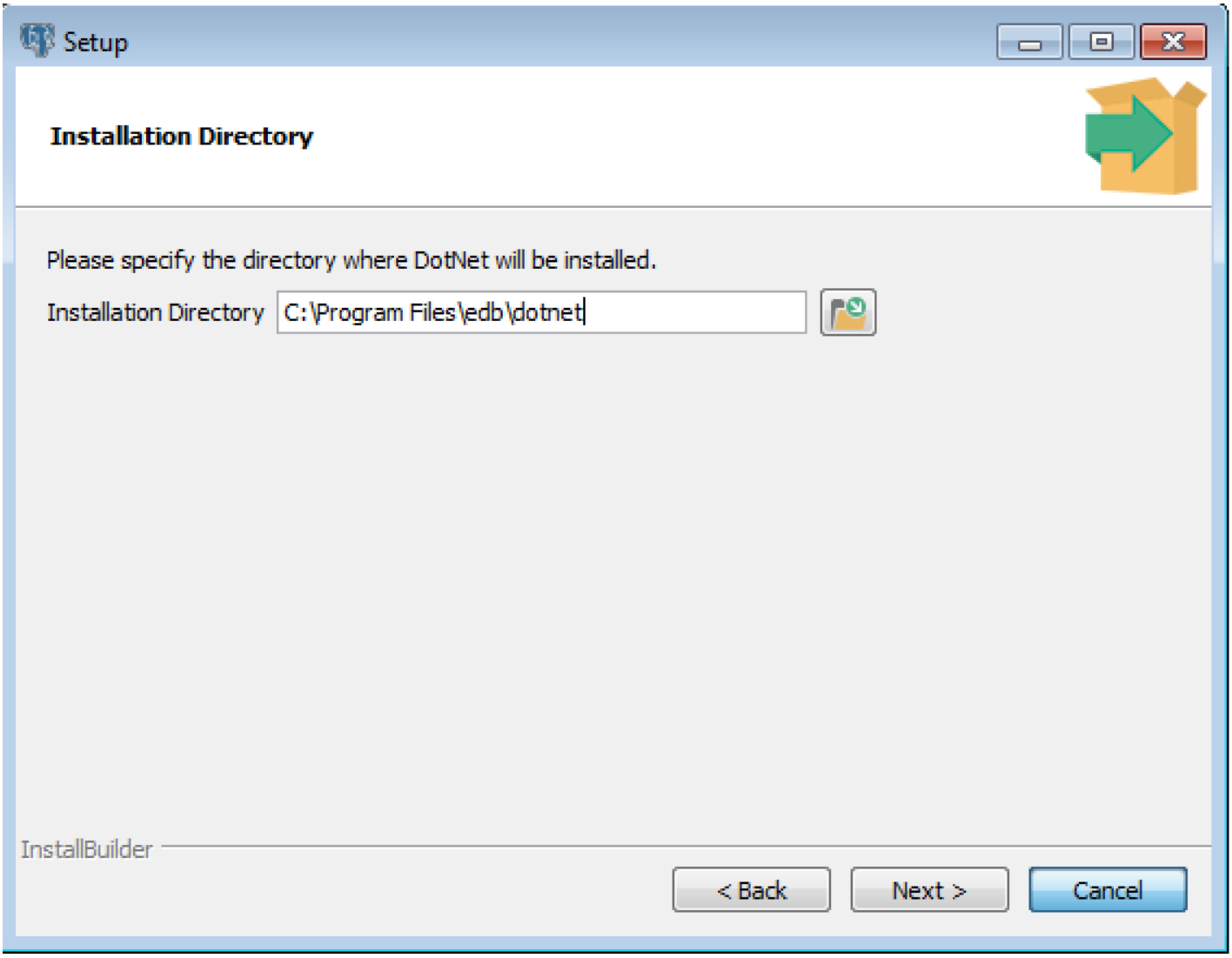
This chapter describes how to install and configure the EDB .NET Connector.

Installing the .NET Connector

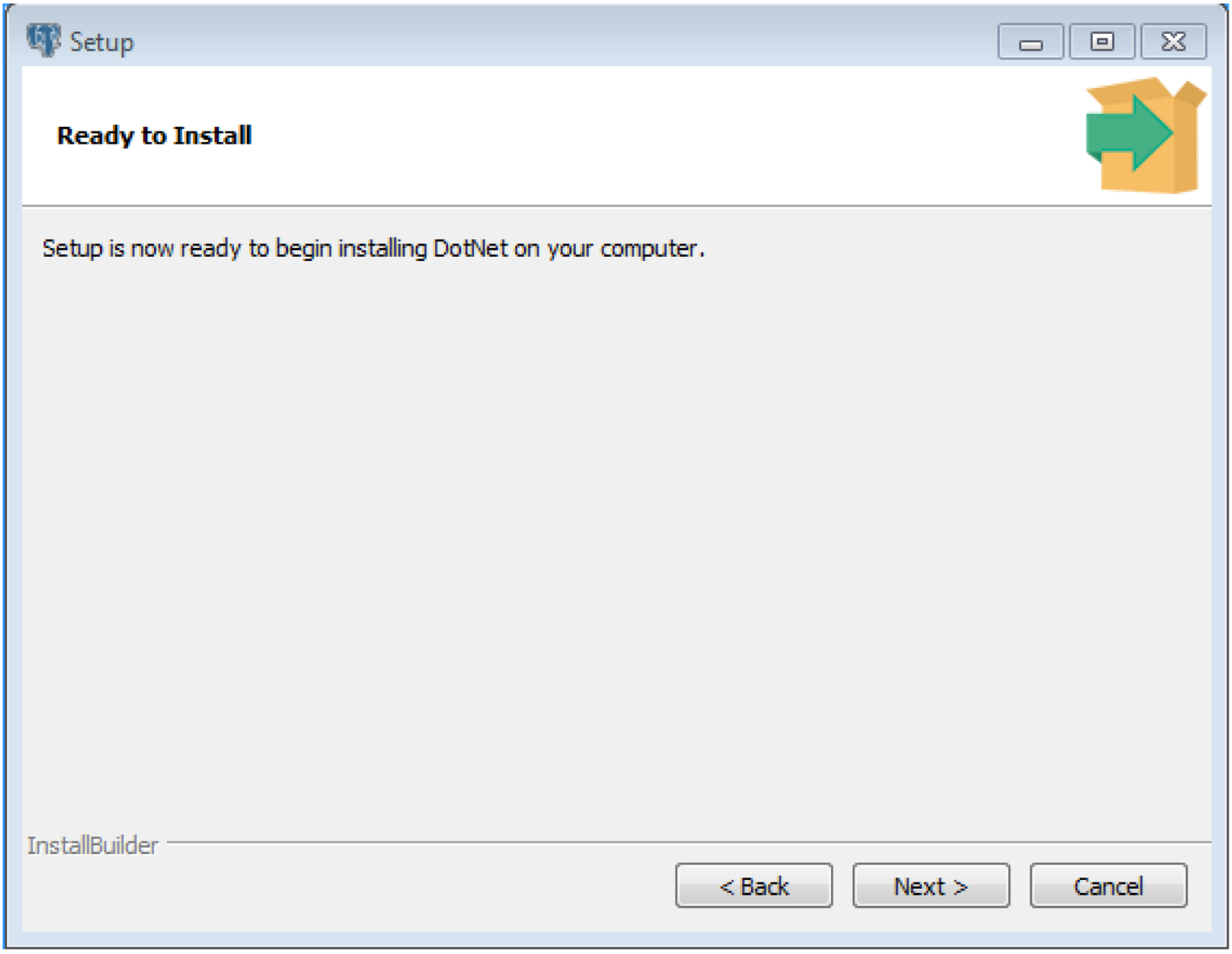
You can use the EDB .NET Connector Installer (available from the EDB website) to add the .NET Connector to your system. After downloading the installer, right-click on the installer icon, and select `Run As Administrator` from the context menu. When prompted, select an installation language and click `OK` to continue to the `Setup` window.



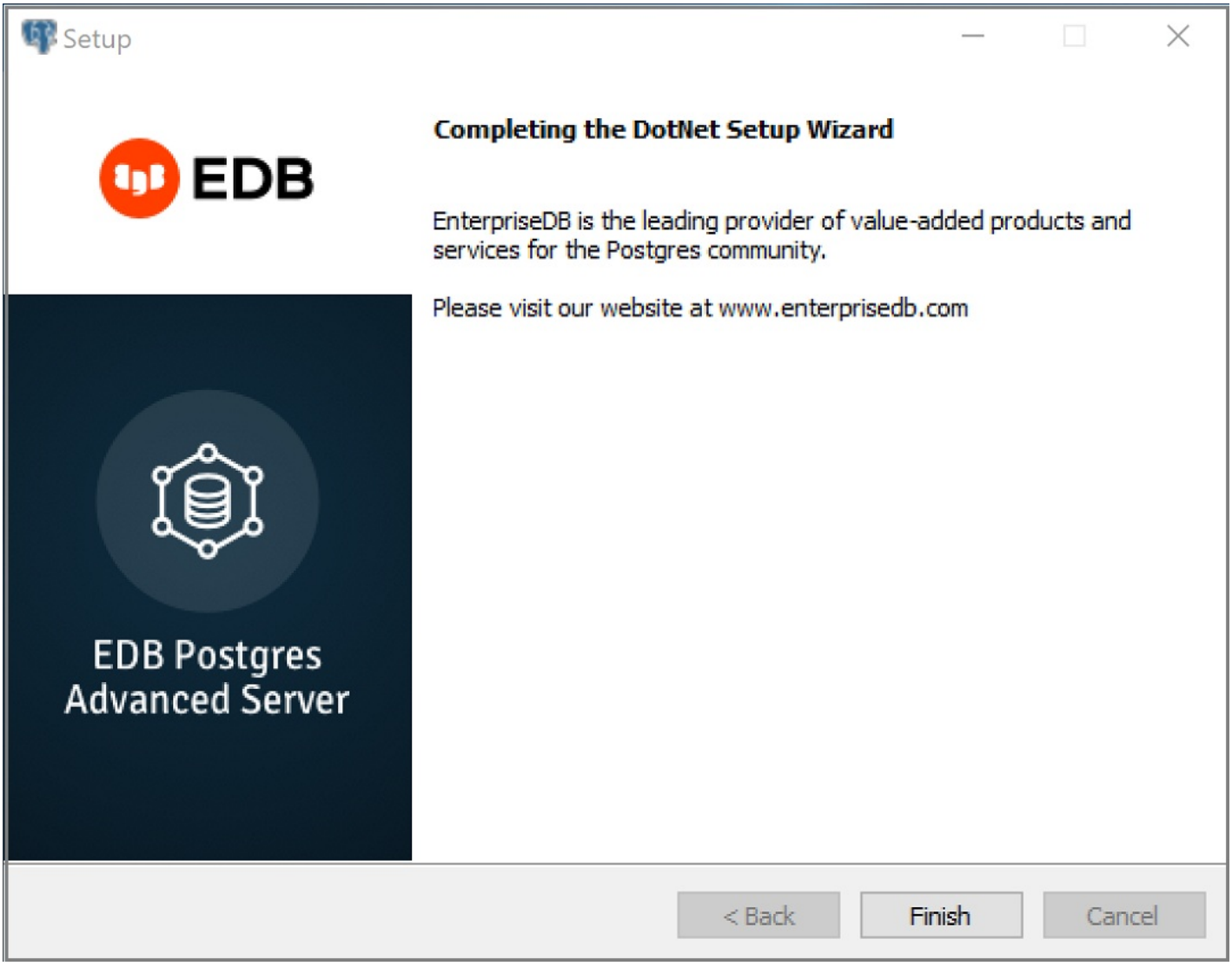
Click Next to continue.



Use the Installation Directory dialog to specify the directory in which the connector will be installed, and click Next to continue.

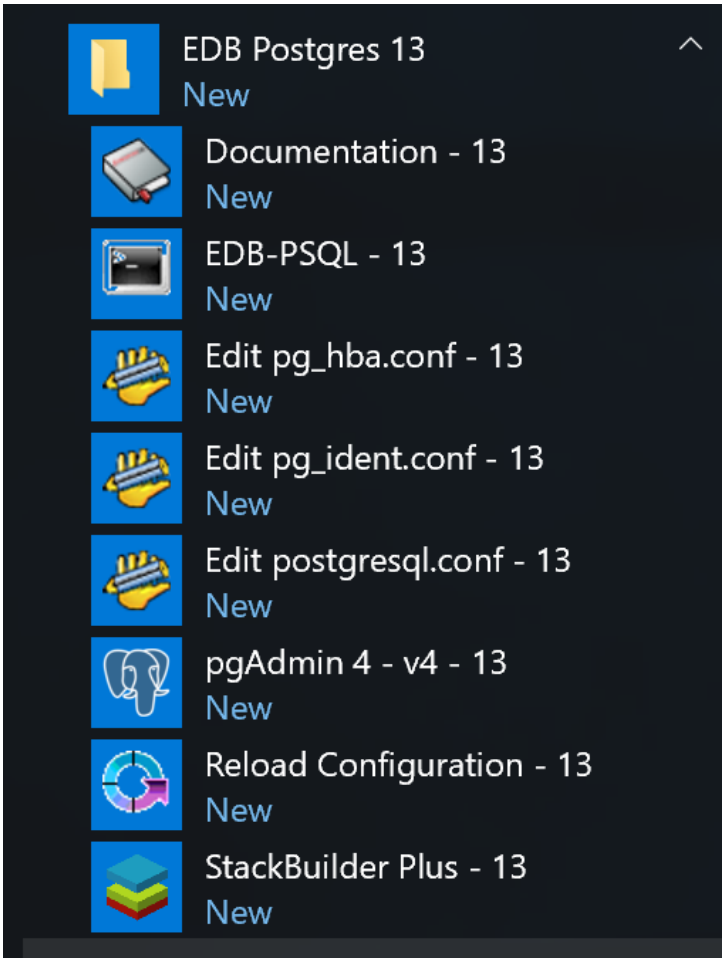


Click Next on the Ready to Install dialog to start the installation; popup dialogs confirm the progress of the installation wizard.



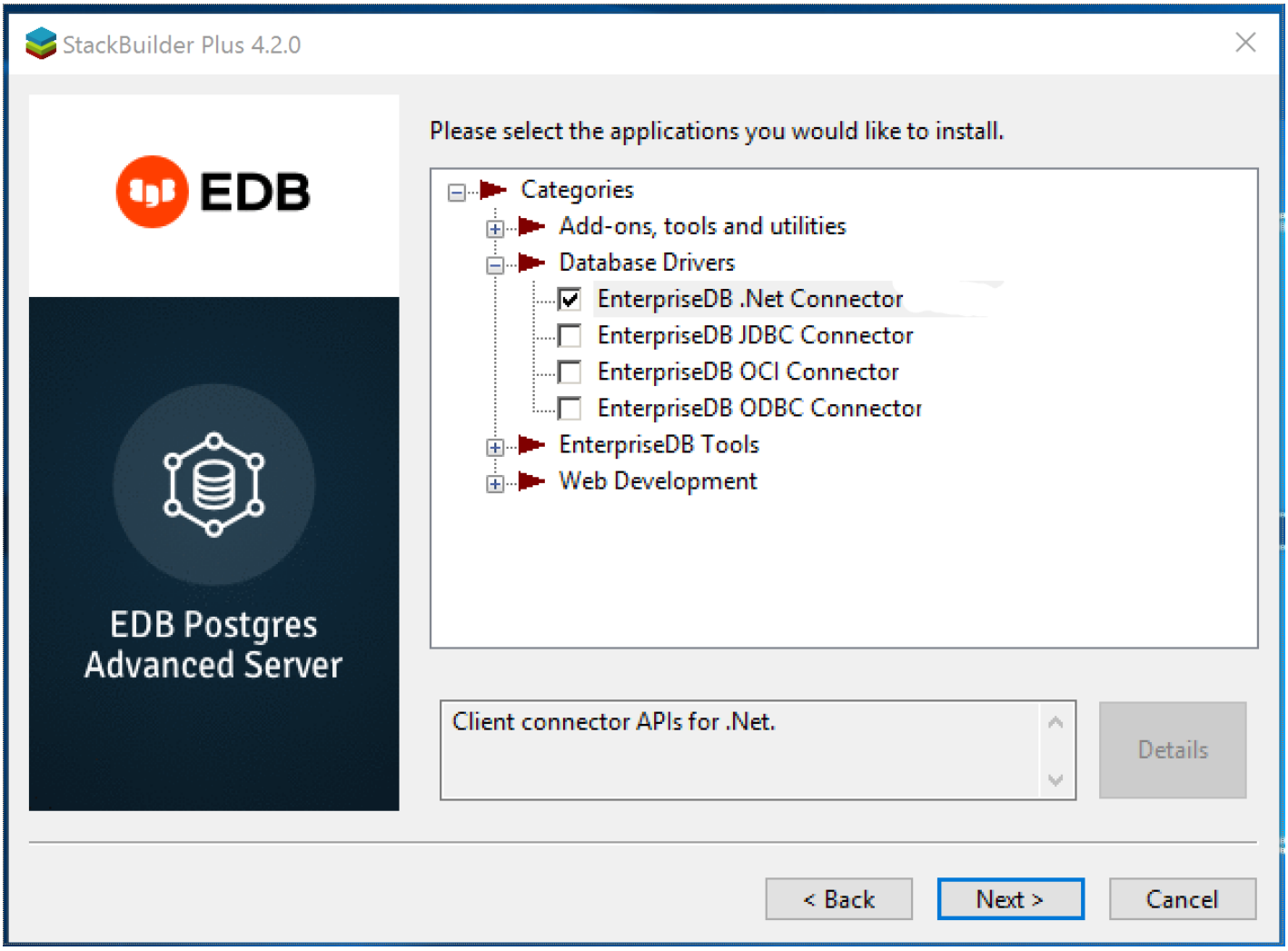
When the wizard informs you that it has completed the setup, click the Finish button to exit the dialog.

You can also use StackBuilder Plus to add or update the connector on an existing Advanced Server installation; to open StackBuilder Plus, select StackBuilder Plus from the Windows Apps menu.



When StackBuilder Plus opens, follow the onscreen instructions.

Select the `EnterpriseDB.Net Connector` option from the `Database Drivers` node of the tree control.



Follow the directions of the onscreen wizard to add or update an installation of an EDB Connector.

Configuring the .NET Connector

Please see the following environment-specific sections for information about configuring the .NET Connector:

- **Referencing the Library Files.** General configuration information applicable to all components.
- **.NET Framework 4.6.1** Instructions for configuring for use with .NET Framework 4.6.1.
- **.NET Framework 4.7.2** Instructions for configuring for use with .NET Framework 4.7.2.
- **.NET Framework 4.8** Instructions for configuring for use with .NET Framework 4.8.
- **.NET Standard 2.0.** Instructions for configuring for use with .NET Standard

2.0.
- **.NET Standard 2.1.** Instructions for configuring for use with .NET Standard 2.1.
- **.NET Core 3.0** Instructions for configuring for use with .NET Core 3.0.
- **Entity Framework 6.** Instructions for configuring for use with Entity Framework.
- **EDB VSIX.** Instructions for configuring for use with EDB VSIX.

Referencing the Library Files

To reference library files with Microsoft Visual Studio:

1. Select the project in the `Solution Explorer`.
2. Select `Add Reference` from the `Project` menu.
3. When the `Add Reference` dialog box opens, browse to select the appropriate library files.

Optionally, the library files can be copied to the specified location.

Before you can use an EDB .NET class, you must import the namespace into your program. Importing a namespace makes the compiler aware of the classes available within the namespace. The namespace is:

```
EnterpriseDB.EDBClient
```

If you are using Entity Framework 6, the following additional namespace is required:

```
EntityFramework6.EntepriseDB.EDBClient
```

The method you use to include the namespace varies by the type of application you are writing. For example, the following command imports a namespace into an `ASP.NET` page:

```
<% import namespace="EnterpriseDB.EDBClient" %>
```

To import a namespace into a C# application, write:

```
using EnterpriseDB.EDBClient;
```

.NET Framework Setup

The following sections describe the setup for various .NET versions.

.NET Framework 4.6.1

If you are using .NET Framework version 4.6.1, the data provider installation path is:

```
C:\Program Files\edb\dotnet\net461\
```

You must add the following dependencies to your project:

```
EnterpriseDB.EDBClient.dll

Microsoft.Bcl.AsyncInterfaces.dll

System.Memory.dll

System.Numerics.Vectors.dll

System.Runtime.CompilerServices.Unsafe.dll

System.Runtime.dll

System.Text.Json.dll

System.Threading.Tasks.Extensions.dll

System.ValueTuple.dll
```

Depending upon the type of application you use, you may be required to import the namespace into the source code. See Referencing the Library Files for this and other information about referencing library files.

.NET Framework 4.7.2

If you are using .NET Framework version 4.7.2, the data provider installation path is:

```
C:\Program Files\edb\dotnet\net472\
```

You must add the following dependencies to your project:

```
EnterpriseDB.EDBClient.dll

Microsoft.Bcl.AsyncInterfaces.dll

System.Memory.dll

System.Numerics.Vectors.dll

System.Runtime.CompilerServices.Unsafe.dll

System.Text.Json.dll

System.Threading.Tasks.Extensions.dll
```

Depending upon the type of application you use, you may be required to import the namespace into the source code. See Referencing the Library Files for this and other information about referencing library files.

.NET Framework 4.8

If you are using .NET Framework version 4.8, the data provider installation path is:

```
C:\Program Files\edb\dotnet\net48\
```

You must add the following dependencies to your project:

```
EnterpriseDB.EDBClient.dll

Microsoft.Bcl.AsyncInterfaces.dll

System.Memory.dll

System.Numerics.Vectors.dll

System.Runtime.CompilerServices.Unsafe.dll
```

> System.Text.Json.dll
>
> System.Threading.Tasks.Extensions.dll

Depending upon the type of application you use, you may be required to import the namespace into the source code. See Referencing the Library Files for this and other information about referencing library files.

.NET Standard 2.0

For .NET Standard Framework 2.0, the data provider installation path is:

> C:\Program Files\edb\dotnet\netstandard2.0\

You must add the following dependencies to your project:

> EnterpriseDB.EDBClient.dll
>
> System.Threading.Tasks.Extensions.dll
>
> System.Runtime.CompilerServices.Unsafe.dll
>
> System.ValueTuple.dll

Note

If your target framework is .Net Core 2.0, then include the following file in your project:

System.Threading.Tasks.Extensions.dll

Depending upon the type of application you use, you may be required to import the namespace into the source code. See Referencing the Library Files for this and other information about referencing library files.

.NET Standard 2.1

For .NET Standard Framework 2.1, the data provider installation path is:

> C:\Program Files\edb\dotnet\netstandard2.1\

The following shared library files are required:

```
EnterpriseDB.EDBClient.dll

System.Memory.dll

System.Runtime.CompilerServices.Unsafe.dll

System.Text.Json.dll

System.Threading.Tasks.Extensions.dll

System.ValueTuple.dll
```

Depending upon the type of application you use, you may be required to import the namespace into the source code. See Referencing the Library Files for this and other information about referencing library files.

.NET Core 3.0

If you are using .NET Core 3.0, the data provider installation path is:

```
C:\Program Files\edb\dotnet\netcoreapp3.0\
```

The following shared library files are required:

```
EnterpriseDB.EDBClient.dll

System.Threading.Tasks.Extensions.dll

System.Runtime.CompilerServices.Unsafe.dll

System.ValueTuple.dll

System.Memory.dll
```

Depending upon the type of application you use, you may be required to import the namespace into the source code. See Referencing the Library Files for this and other information about referencing library files.

Entity Framework 6

To configure the .NET Connector for use with Entity Framework, the data provider installation path is:

For net461

```
C:\Program Files\edb\dotnet\EF\net461
```

The following shared library file is required:

```
EntityFramework6.EnterpriseDB.EDBClient.dll
```

For net472

```
C:\Program Files\edb\dotnet\EF\net472
```

The following shared library file is required:

```
EntityFramework6.EnterpriseDB.EDBClient.dll
```

For net48

```
C:\Program Files\edb\dotnet\EF\net48
```

The following shared library file is required:

```
EntityFramework6.EnterpriseDB.EDBClient.dll
```

Note

Entity Framework can be used with the `EnterpriseDB.EDBClient.dll` library available in the `net461`, `net472` and `net48` subdirectories.

See Referencing the Library Files for information about referencing library files.

Add the `<DbProviderFactories>` entries for the `ADO.NET` driver for Postgres to the `app.config` file. Add the following entries:

```
<add name="EnterpriseDB.EDBClient"
 invariant="EnterpriseDB.EDBClient"
```

```
 description=".NET Data Provider for EnterpriseDB PostgreSQL”
 type="EnterpriseDB.EDBClient.EDBFactory, EnterpriseDB.EDBClient,
Version=4.1.6.1, Culture=neutral, PublicKeyToken=5d8b90d52f46fda7"
 support="FF"/>
```

In the project’s `app.config` file add the following entry for provider services under the EntityFramework/providers tag:

```
<provider invariantName="EnterpriseDB.EDBClient"
 type="EnterpriseDB.EDBClient.EDBServices,
EntityFramework6.EnterpriseDB.EDBClient">
</provider>
```

The following is an example of the `app.config` file:

```
<?xml version="1.0" encoding="utf-8" ?>
<configuration>
 <configSections>
   <section name="entityFramework"
type="System.Data.Entity.Internal.ConfigFile.EntityFrameworkSection,
EntityFramework, Version=6.0.0.0, Culture=neutral,
PublicKeyToken=b77a5c561934e089" requirePermission="false"/>
 </configSections>

   <startup>
      <supportedRuntime version="v4.0" sku=".NETFramework,Version=v4.5"
/>
   </startup>

<entityFramework>
  <providers>
    <provider invariantName="EnterpriseDB.EDBClient"
type="EnterpriseDB.EDBClient.EDBServices,
EntityFramework6.EnterpriseDB.EDBClient"></provider>
  </providers>
</entityFramework>
```

```
 <system.data>
   <DbProviderFactories>
     <remove invariant="EnterpriseDB.EDBClient"/>
     <add name="EnterpriseDB Data Provider"
invariant="EnterpriseDB.EDBClient" support="FF" description=".Net Framework
Data Provider for Postgresql" type="EnterpriseDB.EDBClient.EDBFactory,
EnterpriseDB.EDBClient"/>
   </DbProviderFactories>
 </system.data>

</configuration>
```

Note

The same entries for `<providers>` and `<DbProviderFactories>` are valid for the `web.config` file and the `app.config` file.

Depending upon the type of application you are using, you may be required to import the namespace into the source code (see Referencing the Library Files).

For usage information about Entity Framework, refer to the Microsoft documentation.

EDB VSIX for Visual Studio 2015/2017/2019

The EDB Data Designer Extensibility Provider (EDB VSIX) is a component that integrates Advanced Server database access into Visual Studio, thus providing Visual Studio integrated features.

EDB VSIX allows you to connect to Advanced Server from within Visual Studio's Server Explorer and create a model from an existing database. Therefore, if Visual Studio features are desired, then EDB VSIX must be utilized.

EDB VSIX files are located in the following directory:

```
C:\Program Files\edb\dotnet\vsix
```

The files available at the above location are:

```
edb_logo.ico
EnterpriseDB.vsix
SSDLToPgSQL.tt
System.ValueTuple.dll
```

Installation and Configuration for Visual Studio 2015/2017/2019

Use the following steps to install and configure EDB VSIX.

Step 1: Install EDB VSIX to the desired version of Visual Studio with the `EnterpriseDB.vsix` installer.

If you already have an earlier version of the VSIX installed, we highly recommended that you uninstall it to avoid conflicts.

It is no longer necessary or recommended to have `EnterpriseDB.EDBClient` in your global assembly cache (GAC).

Step 2: Relaunch Visual Studio and verify from the `Tools > Extensions and Updates…` menu that the EDB extension is installed.

Step 3: Use the `gacutil` utility at the Visual Studio Developers Command Line to add following libraries to the global assembly cache (GAC):

```
System.ValueTuple.dll
System.Threading.Tasks.Extensions.dll
System.Runtime.CompilerServices.Unsafe.dll
System.Memory.dll
Microsoft.Bcl.AsyncInterfaces.dll
System.Text.Json.dll
```

For example:

```
> gacutil.exe /i System.ValueTuple.dll
```

Step 4: From the Server Explorer, right-click on `Data Connections`, click `Add Connection`, and verify that the `Enterprisedb Postgres Database` data source is available.

Model First and Database First Usage

Step 1: Add the `<DbProviderFactories>` entries for the ADO.NET driver to the `machine.config` file. Include the following entries:

```
<add name="EnterpriseDB.EDBClient"
 invariant="EnterpriseDB.EDBClient"
 description=".NET Data Provider for EnterpriseDB PostgreSQL"
 type="EnterpriseDB.EDBClient.EDBFactory, EnterpriseDB.EDBClient,
Version=4.1.6.1, Culture=neutral, PublicKeyToken=5d8b90d52f46fda7"
 support="FF"/>
```

For the attribute-value pairs, the double-quoted strings should not contain excess white space characters, but be configured on a single line. The examples shown in this section may be split on multiple lines for clarity, but should actually be configured within a single line such as the following:

`description=".NET Data Provider for EnterpriseDB PostgreSQL"`

For 64-bit Windows, the `machine.config` file is in the following location:

`C:\Windows\Microsoft.NET\Framework64\v4.0.30319\Config\machine.config`

For 32-bit Windows, the `machine.config` file is in the following location:

`C:\Windows\Microsoft.NET\Framework\v4.0.30319\Config\machine.config`

Step 2: Place the DDL generation template `SSDLToPgSQL.tt` in the Visual Studio `EntityFramework Tools\DBGen\` folder as shown in the following example:

```
C:\Program Files (x86)\Microsoft Visual Studio
14.0\Common7\IDE\Extensions\Microsoft\EntityFramework Tools\DBGen\
```

Note

Select this template `SSDLToPgSQL.tt` in your EDMX file properties.

Step 3: Add the `EnterpriseDB.EDBClient.dll` and `EntityFramework6.EnterpriseDB.EDBClient.dll` files to project references. see Referencing the Library Files for information about referencing library files.

Step 4: Configure your Entity Framework application in either of following two ways:

- Code-based
- Config-based.

Code-based

Define a class that inherits from `DbConfiguration` in the same assembly as your class inheriting `DbContext`. Ensure that you configure `provider services`, a `provider factory`, and a `default connection factory` as shown below:

```
using EnterpriseDB.EDBClient;
using System.Data.Entity;

class EDBConfiguration : DbConfiguration
{
  public EDBConfiguration()
  {

      var name = "EnterpriseDB.EDBClient";

      SetProviderFactory(providerInvariantName: name,
      providerFactory: EnterpriseDB.EDBClient.EDBFactory.Instance);

      SetProviderServices(providerInvariantName: name,
      provider: EnterpriseDB.EDBClient.EDBServices.Instance);

      SetDefaultConnectionFactory(connectionFactory: new
EnterpriseDB.EDBClient.EDBConnectionFactory());
  }
}
```

Config-based

In the project's `app.config` file, add the following entry for provider services under the EntityFramework/providers tag:

```
<provider invariantName="EnterpriseDB.EDBClient"
 type="EnterpriseDB.EDBClient.EDBServices,
EntityFramework6.EnterpriseDB.EDBClient">
</provider>
```

The following is an example of the `app.config` file.

```
<?xml version="1.0" encoding="utf-8" ?>
<configuration>
 <configSections>
   <section name="entityFramework"
type="System.Data.Entity.Internal.ConfigFile.EntityFrameworkSection,
EntityFramework, Version=6.0.0.0, Culture=neutral,
PublicKeyToken=b77a5c561934e089" requirePermission="false"/>
 </configSections>

   <startup>
      <supportedRuntime version="v4.0" sku=".NETFramework,Version=v4.5"
/>
   </startup>

 <entityFramework>
   <providers>
     <provider invariantName="EnterpriseDB.EDBClient"
type="EnterpriseDB.EDBClient.EDBServices,
EntityFramework6.EnterpriseDB.EDBClient"></provider>
   </providers>
 </entityFramework>

 <system.data>
   <DbProviderFactories>
     <remove invariant="EnterpriseDB.EDBClient"/>
     <add name="EnterpriseDB Data Provider"
invariant="EnterpriseDB.EDBClient" support="FF" description=".Net Framework
Data Provider for EDB Postgres" type="EnterpriseDB.EDBClient.EDBFactory,
EnterpriseDB.EDBClient"/>
```

```
  </DbProviderFactories>
 </system.data>

</configuration>
```

5 Using the .NET Connector

The sections that follow provide examples that demonstrate using the EDB object classes that are provided by the EDB .NET Connector that allow a .NET application to connect to and interact with an Advanced Server database.

To use the examples in this guide, place the .NET library files in the same directory as the compiled form of your application. All of the examples are written in C# and each is embedded in an ASP.NET page; the same logic and code would be applicable with other .NET applications (WinForm or console applications, for example).

Please create and save the following `web.config` file in the same directory as the sample code. The examples make use of the `DB_CONN_STRING` key from this configuration file to return a connection string from the Advanced Server host.

```
<?xml version="1.0" encoding="utf-8"?>
<configuration>
<appSettings>
    <add key="DB_CONN_STRING" value="Server=127.0.0.1;Port=5444;
    User Id=enterprisedb;Password=enterprisedb;Database=edb" />
</appSettings>
</configuration>
```

An Advanced Server connection string for an ASP.NET web application is stored in the `web.config` file. If you are writing an application that does not use ASP.NET, provide the connection information in an application configuration file (such as `app.config`).

6 Opening a Database Connection

An `EDBConnection` object is responsible for handling the communication between an instance of Advanced Server and a .NET application. Before you can access data stored in an Advanced Server database, you must create and open an `EDBConnection`.

The examples that follow demonstrate the basic steps for connecting to an instance of Advanced Server. You must:

1. Import the namespace `EnterpriseDB.EDBClient`.
2. Create an instance of `EDBConnection`.
3. Initialize the `EDBConnection` object by passing a connection string as a parameter to the constructor for the `EDBConnection` class.
4. Call the `Open` method of the `EDBConnection` object to open the connection.

Connection String Parameters

A valid connection string should specify location and authentication information for an Advanced Server instance. You must provide the connection string before opening the connection. A connection string must contain:

- The name or IP address of the server
- The name of the Advanced Server database
- The name of an Advanced Server user
- The password associated with that user

The following parameters may be included in the connection string:

`CommandTimeout`

> `CommandTimeout` specifies the length of time (in seconds) to wait for a command to finish execution before throwing an exception. The default value is `20`.

`ConnectionLifeTime`

> Use `ConnectionLifeTime` to specify the length of time (in seconds) to wait before closing unused connections in the pool. The default value is `15`.

Database

> Use the `Database` parameter to specify the name of the database to which the application should connect. If a database name is not specified, the database name will default to the name of the connecting user.

Encoding

> The `Encoding` parameter is obsolete; the parameter always returns the string unicode, and silently ignores attempts to set it.

Integrated Security

> By default, `Integrated Security` is set to `false`, and Windows Integrated Security is disabled. Specify a value of `true` to use Windows Integrated Security.

Load Role Based Tables

> Use `Load Role Based Tables` to load table OIDs based on role. This change only impacts the loading of table type OID, and not the composite type. The default value is `false`. Setting this parameter to `true` triggers the new functionality.

MaxPoolSize

> `MaxPoolSize` instructs `EDBConnection` to dispose of pooled connections when the pool exceeds the specified number of connections. The default value is `20`.

MinPoolSize

> `MinPoolSize` instructs `EDBConnection` to pre-allocate the specified number of connections with the server. The default value is `1`.

Password

> When using clear text authentication, specify the password that will be used to establish a connection with the server.

`Pooling`

> By default, `Pooling` is set to `true` to enable connection pooling. Specify a value of `false` to disable connection pooling.

`Port`

> The `Port` parameter specifies the port to which the application should connect.

`Protocol`

> The specific protocol version to use (instead of automatic); specify an integer value of 2 or 3.

`SearchPath`

> Use the `SearchPath` parameter to change the search path to named and public schemas.

`Server`

> The name or IP address of the Advanced Server host.

`SSL`

> By default, `SSL` is set to `false`; specify a value of `true` to attempt a secure connection.

`sslmode`

> Use `sslmode` to specify an SSL connection control preference. `sslmode` can be:
>
> `prefer` - Use SSL if possible.
>
> `require` - Throw an exception if an SSL connection cannot be established.
>
> `allow` - Connect without SSL. This parameter is not supported.
>
> `disable` - Do not attempt an SSL connection. This is the default behavior.

`SyncNotification`

> Use the `SyncNotification` parameter to specify that `EDBDataprovider` should use synchronous notifications. The default value is `false`.

`Timeout`

> `Timeout` specifies the length of time (in seconds) to wait for an open connection. The default value is `15`.

`User Id`

> The `User Id` parameter specifies the user name that should be used for the connection.

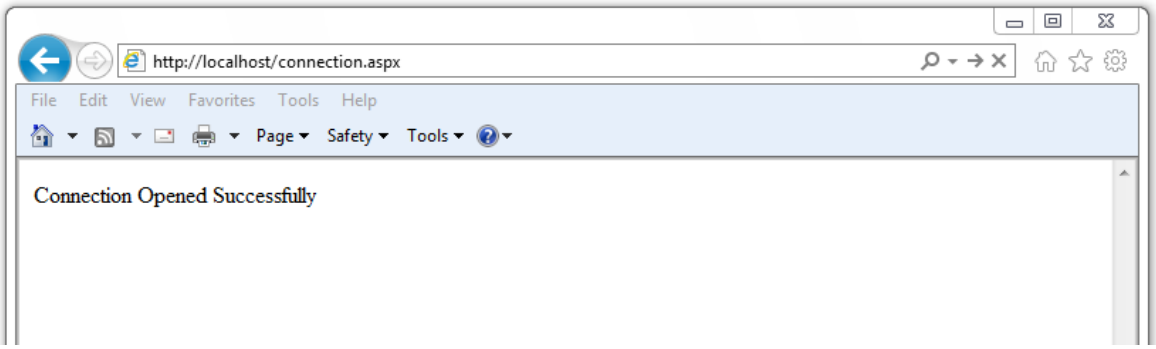
Example - Opening a Database Connection using ASP.NET

The following example demonstrates how to open a connection to an instance of Advanced Server and then close the connection. The connection is established using the credentials specified in the `DB_CONN_STRING` configuration parameter (see Using the .Net Connector for an introduction to connection information and also see Connection String Parameters for connection parameters).

```
<% @ Page Language="C#" %>
<% @Import Namespace="EnterpriseDB.EDBClient" %>
<% @Import Namespace="System.Configuration" %>

<script language="C#" runat="server">

private void Page_Load(object sender, System.EventArgs e)
{
  string strConnectionString = ConfigurationManager.AppSettings
    ["DB_CONN_STRING"];

  EDBConnection conn = new EDBConnection(strConnectionString);
```

```
 try
 {
   conn.Open();
   Response.Write("Connection opened successfully");
 }

 catch(EDBException exp)
 {
   exp.ToString();
 }

 finally
 {
   conn.Close();
 }
}

</script>
```

If the connection is successful, a browser will display the following:



Example - Opening a Database Connection from a Console Application

The following example opens a connection with an Advanced Server database using a console-based application.

Before writing the code for the console application, create an `app.config` file that stores the connection string to the database. Using a configuration file makes it

convenient to update the connection string if the information changes.

```
<?xml version="1.0" encoding="utf-8" ?>
<configuration>
  <appSettings>
     <add key="DB_CONN_STRING" value = "Server=127.0.0.1;Port=5444;
     User Id=enterprisedb;Password=enterprisedb;Database=edb"/>
  </appSettings>
</configuration>
```

Using your text editor of choice, enter the following code sample into a file:

```
using System;
using System.Data;
using EnterpriseDB.EDBClient;
using System.Configuration;

namespace EnterpriseDB
{

  class EDB
  {

    static void Main(string[] args)
    {
        string strConnectionString = ConfigurationManager.AppSettings
       ["DB_CONN_STRING"];

       EDBConnection conn = new EDBConnection(strConnectionString);

        try
        {
        conn.Open();
        Console.WriteLine("Connection Opened Successfully");
        }
```

```
        catch(Exception exp)
        {
        throw new Exception(exp.ToString());
        }

        finally
        {
      conn.Close();
        }
    }
  }
}
```

Save the file as `EDBConnection-Sample.cs` and compile it with the following command:

```
csc /r:EnterpriseDB.EDBClient.dll /out:Console.exe EDBConnection-Sample.cs
```

Compiling the sample should generate a `Console.exe` file; you can execute the sample code by entering `Console.exe`. When executed, the console should verify that the:

```
Connection Opened Successfully
```

Example - Opening a Database Connection from a Windows Form Application

The following example demonstrates opening a database connection using a .NET WinForm application. To use the example, save the following code as `WinForm-Example.cs` in a directory that contains the library files.

```
using System;
using System.Windows.Forms;
using System.Drawing;
using EnterpriseDB.EDBClient;
```

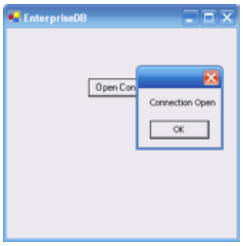
```
namespace EDBTestClient
{

 class Win_Conn
 {
    static void Main(string[] args)
    {
       Form frmMain = new Form();
       Button btnConn = new Button();
       btnConn.Location = new System.Drawing.Point(104, 64);
       btnConn.Name = "btnConn";
       btnConn.Text = "Open Connection";
       btnConn.Click += new System.EventHandler(btnConn_Click);

       frmMain.Controls.Add(btnConn);
       frmMain.Text = "EnterpriseDB";

       Application.Run(frmMain);
    }

    private static void btnConn_Click(object sender, System.EventArgs e)
    {
       EDBConnection conn = null;
       try
       {
          string connectionString = "Server=10.90.1.29;port=5444;
          username=edb;password=edb;database=edb";
          conn = new EDBConnection(connectionString);
          conn.Open();
          MessageBox.Show("Connection Open");
       }
       catch(EDBException exp)
       {
          MessageBox.Show(exp.ToString());
       }
       finally
```

```
        {
            conn.Close();
        }
    }
  }
}
```

Note that you must change the database connection string to point to the database that you want to connect to before compiling the file with the following command:

```
csc /r:EnterpriseDB.EDBClient.dll /out:WinForm.exe WinForm-Example.cs
```

This command should generate a `WinForm.exe` file within the same folder that the executable was compiled under. Invoking the executable will display:



7 Retrieving Database Records

You can use a `SELECT` statement to retrieve records from the database via a `SELECT` command. To execute a `SELECT` statement you must:

- Create and open a database connection.
- Create an `EDBCommand` object that represents the `SELECT` statement.
- Execute the command with the `ExecuteReader()` method of the `EDBCommand` object returning a `EDBDataReader`
- Loop through the `EDBDataReader` displaying the results or binding the `EDBDataReader` to some control.

An `EDBDataReader` object represents a forward-only and read-only stream of

database records, presented one record at a time. To view a subsequent record in the stream, you must call the `Read()` method of the `EDBDataReader` object.

The example that follows:

1. Imports the Advanced Server namespace: `EnterpriseDB.EDBClient`
2. Initializes an `EDBCommand` object with a `SELECT` statement.
3. Opens a connection to the database.
4. Executes the `EDBCommand` by calling the `ExecuteReader` method of the `EDBCommand` object.

1. Loops through the contents of the `EDBDataReader` object to display the records returned by the query within a `WHILE` loop.

The `Read()` method advances to the next record (if a record exists) and returns `true` if a record exists, or `false` to indicate that the `EDBDataReader` has reached the end of the result set.

```
<% @ Page Language="C#" %>
<% @Import Namespace="EnterpriseDB.EDBClient" %>
<% @Import Namespace="System.Data" %>
<% @Import Namespace="System.Configuration" %>

<script language="C#" runat="server">

private void Page_Load(object sender, System.EventArgs e)
{
  string strConnectionString = ConfigurationManager.AppSettings
  ["DB_CONN_STRING"];
  EDBConnection conn = new EDBConnection(strConnectionString);

  try
  {
     conn.Open();
     EDBCommand cmdSelect = new EDBCommand("SELECT * FROM
dept",conn);
     cmdSelect.CommandType = CommandType.Text;
     EDBDataReader drDept = cmdSelect.ExecuteReader();
```

```
    while(drDept.Read())
    {
        Response.Write("Department Number: " + drDept["deptno"]);
        Response.Write("\tDepartment Name: " + drDept["dname"]);
        Response.Write("\tDepartment Location: " + drDept["loc"]);
        Response.Write("<br>");
    }

  }

  catch(Exception exp)
{
    Response.Write(exp.ToString());
  }
  finally
{
    conn.Close();
  }
}
</script>
```

To exercise the sample code, save the code in your default web root directory in a file named:

```
selectEmployees.aspx
```

To invoke the program, open a web-browser, and browse to:

```
http://localhost/selectEmployees.aspx
```

Retrieving a Single Database Record

To retrieve a single result from a query, use the `ExecuteScalar()` method of the `EDBCommand` object. The `ExecuteScalar()` method returns the first value of the first column of the first row of the `DataSet` generated by the specified query.

```
<% @ Page Language="C#" %>
<% @Import Namespace="EnterpriseDB.EDBClient" %>
<% @Import Namespace="System.Data" %>
<% @Import Namespace="System.Configuration" %>

<script language="C#" runat="server">

private void Page_Load(object sender, System.EventArgs e)
{
  string strConnectionString = ConfigurationManager.AppSettings
  ["DB_CONN_STRING"];
  EDBConnection conn = new EDBConnection(strConnectionString);
  try
  {
      conn.Open();
      EDBCommand cmd = new EDBCommand("SELECT MAX(sal) FROM
emp",conn);

      cmd.CommandType = CommandType.Text;

      int maxSal = Convert.ToInt32(cmd.ExecuteScalar());

      Response.Write("Emp Number: " + maxSal);

  }
  catch(Exception exp)
  {
    Response.Write(exp.ToString());
  }
  finally
  {
    conn.Close();
  }
}
</script>
```

Save the sample code in a file in a web root directory named:

```
selectscalar.aspx
```

To invoke the sample code, open a web-browser, and browse to:

```
http://localhost/selectScalar.aspx
```

Please note that the sample includes an explicit conversion of the value returned by the `ExecuteScalar()` method. The `ExecuteScalar()` method returns an object; to view the object, you must convert it into an integer value by using the `Convert.ToInt32` method.

8 Parameterized Queries

A `parameterized query` is a query with one or more parameter markers embedded in the SQL statement. Before executing a parameterized query, you must supply a value for each marker found in the text of the SQL statement.

Parameterized queries are useful when you don't know the complete text of a query at the time you write your code. For example, the value referenced in a `WHERE` clause may be calculated from user input.

As demonstrated in the following example, you must declare the data type of each parameter specified in the parameterized query by creating an `EDBParameter` object and adding that object to the command's parameter collection. Then, you must specify a `value` for each parameter by calling the parameter's `Value()` function.

The example demonstrates use of a parameterized query with an `UPDATE` statement that increases an employee salary:

```
<% @ Page Language="C#" Debug="true"%>
<% @Import Namespace="EnterpriseDB.EDBClient" %>
<% @Import Namespace="System.Data" %>
```

```
<% @Import Namespace="System.Configuration" %>

<script language="C#" runat="server" >

private void Page_Load(object sender, System.EventArgs e)
{
 string strConnectionString = ConfigurationManager.AppSettings
 ["DB_CONN_STRING"];
 EDBConnection conn = new EDBConnection(strConnectionString);

 string updateQuery  = "UPDATE emp SET sal = sal+500 where empno = :ID";

 try {
    conn.Open();

    EDBCommand cmdUpdate = new EDBCommand(updateQuery,conn);

    cmdUpdate.Parameters.Add
    (new EDBParameter(":ID", EDBTypes.EDBDbType.Integer));

    cmdUpdate.Parameters[0].Value = 7788;

    cmdUpdate.ExecuteNonQuery();

    Response.Write("Record Updated");

 }
 catch(Exception exp) {
    Response.Write(exp.ToString());
 }
 finally {
    conn.Close();
 }
}
</script>
```

Save the sample code in a file in a web root directory named:

> updateSalary.aspx

To invoke the sample code, open a web-browser, and browse to:

> http://localhost/updateSalary.aspx

9 Inserting Records in a Database

You can use the ExecuteNonQuery() method of EDBCommand to add records to a database stored on an Advanced Server host with an INSERT command.

In the example that follows, the INSERT command is stored in the variable cmd. The values prefixed with a colon (:) are placeholders for EDBParameters that are instantiated, assigned values, and then added to the INSERT command's parameter collection in the statements that follow. The INSERT command is executed by the ExecuteNonQuery() method of the cmdInsert object.

The example adds a new employee to the emp table:

```
<% @ Page Language="C#" Debug="true"%>
<% @Import Namespace="EnterpriseDB.EDBClient" %>
<% @Import Namespace="System.Data" %>
<% @Import Namespace="System.Configuration" %>

<script language="C#" runat="server" >

private void Page_Load(object sender, System.EventArgs e)
{
  string strConnectionString = ConfigurationManager.AppSettings
  ["DB_CONN_STRING"];
  EDBConnection conn = new EDBConnection(strConnectionString);
```

```
 try
 {
   conn.Open();

   string cmd = "INSERT INTO emp(empno,ename) VALUES(:EmpNo,
:EName)";

   EDBCommand cmdInsert = new EDBCommand(cmd,conn);

   cmdInsert.Parameters.Add(new EDBParameter(":EmpNo",
     EDBTypes.EDBDbType.Integer));

   cmdInsert.Parameters[0].Value = 1234;

   cmdInsert.Parameters.Add(new EDBParameter(":EName",
     EDBTypes.EDBDbType.Text));

   cmdInsert.Parameters[1].Value = "Lola";

   cmdInsert.ExecuteNonQuery();
   Response.Write("Record inserted successfully");
 }

 catch(Exception exp)
   {
     Response.Write(exp.ToString());
 }
 finally
{
     conn.Close();
 }
}
</script>
```

Save the sample code in a file in a web root directory named:

> insertEmployee.aspx

To invoke the sample code, open a web-browser, and browse to:

> http://localhost/insertEmployee.aspx

10 Deleting Records in a Database

You can use the `ExecuteNonQuery()` method of `EDBCommand` to delete records from a database stored on an Advanced Server host with a `DELETE` statement.

In the example that follows, the `DELETE` command is stored in the variable `strDeleteQuery`. The code passes the employee number to the Delete command (specified by: `EmpNo`). The command is then executed using the `ExecuteNonQuery()` method. The following example deletes the employee inserted in the previous example:

```
<% @ Page Language="C#" Debug="true"%>
<% @Import Namespace="EnterpriseDB.EDBClient" %>
<% @Import Namespace="System.Data" %>
<% @Import Namespace="System.Configuration" %>

<script language="C#" runat="server" >

private void Page_Load(object sender, System.EventArgs e)
{
  string strConnectionString = ConfigurationManager.AppSettings
  ["DB_CONN_STRING"];

  EDBConnection conn = new EDBConnection(strConnectionString);

  string strDeleteQuery  = "DELETE FROM emp WHERE empno = :ID";
```

```
 try
{
    conn.Open();

    EDBCommand deleteCommand = new
EDBCommand(strDeleteQuery,conn);

    deleteCommand.Parameters.Add
    (new EDBParameter(":ID", EDBTypes.EDBDbType.Integer));

    deleteCommand.Parameters[0].Value = 1234;

    deleteCommand.ExecuteNonQuery();

    Response.Write("Record Deleted");

 }

 catch(Exception exp)
{

    Response.Write(exp.ToString());

 }

 finally
{

    conn.Close();

 }
}
</script>
```

Save the sample code in a file in a web root directory named:

> `deleteEmployee.aspx`

To invoke the sample code, open a web-browser, and browse to:

> `http://localhost/deleteEmployee.aspx`

11 Using SPL Stored Procedures in your .NET Application

You can include SQL statements in an application in two ways:

- By adding the SQL statements directly in the .NET application code.
- By packaging the SQL statements in a stored procedure, and executing the stored procedure from the .NET application.

In some cases, a stored procedure can provide advantages over embedded SQL statements. Stored procedures support complex conditional and looping constructs that are difficult to duplicate with SQL statements embedded directly in an application.

You can also see a significant improvement in performance by using stored procedures; a stored procedure only needs to be parsed, compiled and optimized once on the server side, while a SQL statement that is included in an application may be parsed, compiled and optimized each time it is executed from a .NET application.

To use a stored procedure in your .NET application you must:

1. Create an SPL stored procedure on the Advanced Server host.
2. Import the `EnterpriseDB.EDBClient` namespace.
3. Pass the name of the stored procedure to the instance of the `EDBCommand`.
4. Change the `EDBCommand.CommandType` to `CommandType.StoredProcedure`.
5. `Prepare()` the command.
6. Execute the command.

Example - Executing a Stored Procedure without Parameters

Our sample procedure prints the name of department 10; the procedure takes no parameters, and returns no parameters. To create the sample procedure, invoke EDB-PSQL and connect to the Advanced Server host database. Enter the following SPL code at the command line:

```
CREATE OR REPLACE PROCEDURE list_dept10
IS
  v_deptname VARCHAR2(30);
BEGIN
  DBMS_OUTPUT.PUT_LINE('Dept No: 10');
  SELECT dname INTO v_deptname FROM dept WHERE deptno = 10;
  DBMS_OUTPUT.PUT_LINE('Dept Name: ' || v_deptname);
END;
```

When Advanced Server has validated the stored procedure it will echo `CREATE PROCEDURE`.

Using the EDBCommand Object to Execute a Stored Procedure

The `CommandType` property of the `EDBCommand` object is used to indicate the type of command being executed. The `CommandType` property is set to one of three possible `CommandType` enumeration values:

- Use the default `Text` value when passing a SQL string for execution.
- Use the `StoredProcedure` value, passing the name of a stored procedure for execution.
- Use the `TableDirect` value when passing a table name. This value passes back all records in the specified table.

The `CommandText` property must contain a SQL string, stored procedure name, or table name depending on the value of the `CommandType` property.

The following example executes the stored procedure:

```
<% @ Page Language="C#" Debug="true"%>
```

```
<% @Import Namespace="EnterpriseDB.EDBClient" %>
<% @Import Namespace="System.Data" %>
<% @Import Namespace="System.Configuration" %>

<script language="C#" runat="server" >

private void Page_Load(object sender, System.EventArgs e)
{
  string strConnectionString = ConfigurationManager.AppSettings
  ["DB_CONN_STRING"];
  EDBConnection conn = new EDBConnection(strConnectionString);



  try
  {
     conn.Open();

     EDBCommand cmdStoredProc = new EDBCommand("list_dept10",conn);
     cmdStoredProc.CommandType = CommandType.StoredProcedure;

     cmdStoredProc.Prepare();
     cmdStoredProc.ExecuteNonQuery();



     Response.Write("Stored Procedure Executed Successfully");

  }
  catch(Exception exp)
{
     Response.Write(exp.ToString());
  }
  finally
{
     conn.Close();
  }
}
```

```
</script>
```

Save the sample code in a file in a web root directory named:

> storedProc.aspx

To invoke the sample code, open a web-browser, and browse to:

> http://localhost/storedProc.aspx

Example - Executing a Stored Procedure with IN Parameters

The following example demonstrates calling a stored procedure that includes `IN` parameters. To create the sample procedure, invoke `EDB-PSQL` and connect to the Advanced Server host database. Enter the following SPL code at the command line:

```
CREATE OR REPLACE PROCEDURE
 EMP_INSERT
 (
   pENAME IN VARCHAR,
   pJOB IN VARCHAR,
   pSAL IN FLOAT4,
   pCOMM IN FLOAT4,
   pDEPTNO IN INTEGER,
   pMgr IN INTEGER
  )
AS
DECLARE
 CURSOR TESTCUR IS SELECT MAX(EMPNO) FROM EMP;
 MAX_EMPNO INTEGER := 10;
BEGIN

 OPEN TESTCUR;
 FETCH TESTCUR INTO MAX_EMPNO;
 INSERT INTO EMP(EMPNO,ENAME,JOB,SAL,COMM,DEPTNO,MGR)
```

```
   VALUES(MAX_EMPNO+1,pENAME,pJOB,pSAL,pCOMM,pDEPTNO,pMgr);
  CLOSE testcur;
END;
```

When Advanced Server has validated the stored procedure it wEDBTypes.EDBDbType.Floatill echo `CREATE PROCEDURE`.

Passing Input Values to a Stored Procedure

Calling a stored procedure that contains parameters is very similar to executing a stored procedure without parameters. The major difference is that when calling a parameterized stored procedure you must use the `EDBParameter` collection of the `EDBCommand` object. When the `EDBParameter` is added to the `EDBCommand` collection, properties such as `ParameterName`, `DbType`, `Direction`, `Size`, and `Value` are set.

The following example demonstrates the process of executing a parameterized stored procedure from a C#.

```
<% @ Page Language="C#" Debug="true"%>
<% @Import Namespace="EnterpriseDB.EDBClient" %>
<% @Import Namespace="System.Data" %>
<% @Import Namespace="System.Configuration" %>

<script language="C#" runat="server" >

private void Page_Load(object sender, System.EventArgs e)
{
  string strConnectionString = ConfigurationManager.AppSettings
  ["DB_CONN_STRING"];
  EDBConnection conn = new EDBConnection(strConnectionString);

  string empName    = "EDB";
  string empJob     = "Manager";
  double salary     = 1000;
  double commission = 0.0;
  int    deptno     = 20;
  int    manager    = 7839;
```

```
try
{
    conn.Open();

    EDBCommand cmdStoredProc = new EDBCommand
    ("emp_insert(:EmpName,:Job,:Salary,:Commission,:DeptNo,
    :Manager)",conn);
    cmdStoredProc.CommandType = CommandType.StoredProcedure;

    cmdStoredProc.Parameters.Add(new EDBParameter
    ("EmpName", EDBTypes.EDBDbType.Varchar));
    cmdStoredProc.Parameters[0].Value = empName;

    cmdStoredProc.Parameters.Add(new EDBParameter
    ("Job", EDBTypes.EDBDbType.Varchar));
    cmdStoredProc.Parameters[1].Value = empJob;

    cmdStoredProc.Parameters.Add(new EDBParameter
    ("Salary", EDBTypes.EDBDbType.Real));
    cmdStoredProc.Parameters[2].Value = salary;

    cmdStoredProc.Parameters.Add(new EDBParameter
    ("Commission", EDBTypes.EDBDbType.Real));
    cmdStoredProc.Parameters[3].Value = commission;

    cmdStoredProc.Parameters.Add(new EDBParameter
    ("DeptNo", EDBTypes.EDBDbType.Integer));
    cmdStoredProc.Parameters[4].Value = deptno;

    cmdStoredProc.Parameters.Add
    (new EDBParameter("Manager", EDBTypes.EDBDbType.Integer));
    cmdStoredProc.Parameters[5].Value = manager;

    cmdStoredProc.Prepare();
```

```
    cmdStoredProc.ExecuteNonQuery();

    Response.Write("Following Information Inserted Successfully
    <br>");
    string  empInfo  = "Employee Name: " + empName + "<br>";
    empInfo += "Job: " + empJob + "<br>";
    empInfo += "Salary: " + salary + "<br>";
    empInfo += "Commission: " + commission + "<br>";
    empInfo += "Manager: " + manager + "<br>";

    Response.Write(empInfo);

  }

  catch(Exception exp)
{
    Response.Write(exp.ToString());
  }
  finally
{
    conn.Close();
  }
}

</script>

</script>
```

Save the sample code in a file in a web root directory named:

```
storedProcInParam.aspx
```

To invoke the sample code, open a web-browser, and browse to:

```
http://localhost/storedProcInParam.aspx
```

In the example, the body of the `Page_Load` method declares and instantiates an `EDBConnection` object. The sample then creates an `EDBCommand` object

with the properties needed to execute the stored procedure.

The example then uses the `Add` method of the `EDBCommand Parameter` collection to add six input parameters.

```
EDBCommand cmdStoredProc = new EDBCommand
("emp_insert(:EmpName,:Job,:Salary,:Commission,:DeptNo,:Manager)",conn);
cmdStoredProc.CommandType = CommandType.StoredProcedure;
```

It assigns a value to each parameter before passing them to the `EMP_INSERT` stored procedure

The `Prepare()` method prepares the statement before calling the `ExecuteNonQuery()` method.

The `ExecuteNonQuery` method of the `EDBCommand` object executes the stored procedure. After the stored procedure has executed, a test record is inserted into the `emp` table and the values inserted are displayed on the webpage.

Example - Executing a Stored Procedure with IN, OUT, and INOUT Parameters

The previous example demonstrated how to pass `IN` parameters to a stored procedure; the following examples demonstrate how to pass `IN` values and return `OUT` values from a stored procedure.

Creating the Stored Procedure

The following stored procedure passes the department number, and returns the corresponding location and department name. To create the sample procedure, open the EDB-PSQL command line, and connect to the Advanced Server host database. Enter the following SPL code at the command line:

```
CREATE OR REPLACE PROCEDURE
 DEPT_SELECT
 (
  pDEPTNO IN  INTEGER,
```

```
   pDNAME  OUT VARCHAR,
   pLOC    OUT VARCHAR
  )
AS
DECLARE
  CURSOR TESTCUR IS SELECT DNAME,LOC FROM DEPT;
  REC RECORD;
BEGIN

  OPEN TESTCUR;
  FETCH TESTCUR INTO REC;

  pDNAME  := REC.DNAME;
  pLOC    := REC.LOC;

  CLOSE testcur;
END;
```

When Advanced Server has validated the stored procedure it will echo `CREATE PROCEDURE`.

Receiving Output Values from a Stored Procedure

When retrieving values from `OUT` parameters you must explicitly specify the direction of out parameters as `Output`. You can retrieve the values from `Output` parameters in two ways:

- Call the `ExecuteReader` method of the `EDBCommand` and explicitly loop through the returned `EDBDataReader`, searching for the values of `OUT` parameters.
- Call the `ExecuteNonQuery` method of `EDBCommand` and explicitly get the value of a declared `Output` parameter by calling that `EDBParameter` value property.

In each method, you must declare each parameter, indicating the `direction` of the parameter (`ParameterDirection.Input`, `ParameterDirection.Output` or `ParameterDirection.InputOutput`). Before invoking the procedure, you must provide a value for each `IN` and `INOUT` parameter. After the procedure returns, you may retrieve the `OUT` and `INOUT` parameter values from the

`command.Parameters[]` array.

The following code listing demonstrates using the `ExecuteReader` method to retrieve a result set:

```
<% @ Page Language="C#" Debug="true"%>
<% @Import Namespace="EnterpriseDB.EDBClient" %>
<% @Import Namespace="System.Data" %>
<% @Import Namespace="System.Configuration" %>

<script language="C#" runat="server" >

private void Page_Load(object sender, System.EventArgs e)
{
 string strConnectionString =
      ConfigurationManager.AppSettings["DB_CONN_STRING"];
 EDBConnection conn = new EDBConnection(strConnectionString);

 try
 {

  conn.Open();
  EDBCommand command = new EDBCommand("DEPT_SELECT
      (:pDEPTNO,:pDNAME,:pLOC)", conn);
  command.CommandType = CommandType.StoredProcedure;

  command.Parameters.Add(new EDBParameter("pDEPTNO",
      EDBTypes.EDBDbType.Integer,10,"pDEPTNO",
      ParameterDirection.Input,false ,2,2,
      System.Data.DataRowVersion.Current,1));

  command.Parameters.Add(new EDBParameter("pDNAME",
      EDBTypes.EDBDbType.Varchar,10,"pDNAME",
      ParameterDirection.Output,false ,2,2,
      System.Data.DataRowVersion.Current,1));

  command.Parameters.Add(new EDBParameter("pLOC",
```

```
        EDBTypes.EDBDbType.Varchar,10,"pLOC",
        ParameterDirection.Output,false ,2,2,
        System.Data.DataRowVersion.Current,1));

    command.Prepare();

    command.Parameters[0].Value = 10;
    EDBDataReader result = command.ExecuteReader();

    int fc = result.FieldCount;

    for (int i = 0; i < 3; i++)
    {
        Console.WriteLine("RESULT[" + i + "]=" +
Convert.ToString(command.Parameters[i].Value));
        Console.WriteLine("\n");
    }

  }

  catch(EDBException exp)
  {
    Response.Write(exp.ToString());
  }
  finally
  {
    conn.Close();
  }
}

</script>
```

The following code listing demonstrates using the `ExecuteNonQuery` method to retrieve a result set:

```
<% @ Page Language="C#" Debug="true"%>
```

```
<% @Import Namespace="EnterpriseDB.EDBClient" %>
<% @Import Namespace="System.Data" %>
<% @Import Namespace="System.Configuration" %>

<script language="C#" runat="server" >

private void Page_Load(object sender, System.EventArgs e)
{
 string strConnectionString = ConfigurationManager.AppSettings
 ["DB_CONN_STRING"];
 EDBConnection conn = new EDBConnection(strConnectionString);

 try
 {

  conn.Open();
  EDBCommand command = new EDBCommand("DEPT_SELECT
   (:pDEPTNO,:pDNAME,:pLOC)", conn);
  command.CommandType = CommandType.StoredProcedure;

  command.Parameters.Add(new EDBParameter("pDEPTNO",
   EDBTypes.EDBDbType.Integer,10,"pDEPTNO",
   ParameterDirection.Input,false ,2,2,
   System.Data.DataRowVersion.Current,1));

  command.Parameters.Add(new EDBParameter("pDNAME",
   EDBTypes.EDBDbType.Varchar,10,"pDNAME",
   ParameterDirection.Output,false ,2,2,
   System.Data.DataRowVersion.Current,1));

  command.Parameters.Add(new EDBParameter("pLOC",
   EDBTypes.EDBDbType.Varchar,10,"pLOC",
   ParameterDirection.Output,false ,2,2,
   System.Data.DataRowVersion.Current,1));

  command.Prepare();
```

```
    command.Parameters[0].Value = 10;
    command.ExecuteNonQuery();

    Response.Write(command.Parameters["pDNAME"].Value.ToString());
    Response.Write(command.Parameters["pLOC"].Value.ToString());
  }

  catch(EDBException exp)
  {
    Response.Write(exp.ToString());
  }
  finally
  {
    conn.Close();
  }
}
</script>
```

12 Using Advanced Queueing

EDB Postgres Advanced Server Advanced Queueing provides message queueing and message processing for the Advanced Server database. User-defined messages are stored in a queue; a collection of queues is stored in a queue table. You should first create a queue table before creating a queue that is dependent on it.

On the server side, procedures in the `DBMS_AQADM` package create and manage message queues and queue tables. Use the `DBMS_AQ` package to add or remove messages from a queue, or register or unregister a PL/SQL callback procedure. For more information about `DBMS_AQ` and `DBMS_AQADM`, click here.

On the client side, application uses EDB.NET driver to enqueue/dequeue

message.

Enqueueing or Dequeueing a Message

For more information about using Advanced Servers Advanced Queueing functionality, see the Database Compatibility for Oracle Developers Built-in Package Guide.

Server-Side Setup

To use Advanced Queueing functionality on your .NET application, you must first create a user defined type, queue table, and queue, and then start the queue on the database server. Invoke EDB-PSQL and connect to the Advanced Server host database. Use the following SPL commands at the command line:

Creating a User-defined Type

To specify a RAW data type, you should create a user-defined type. The following example demonstrates creating a user-defined type named as `myxml`.

```
CREATE TYPE myxml AS (value XML);
```

Creating the Queue Table

A queue table can hold multiple queues with the same payload type. The following example demonstrates creating a table named `MSG_QUEUE_TABLE`.

```
EXEC DBMS_AQADM.CREATE_QUEUE_TABLE
     (queue_table => 'MSG_QUEUE_TABLE',
      queue_payload_type => 'myxml',
      comment => 'Message queue table');
END;
```

Creating the Queue

The following example demonstrates creating a queue named `MSG_QUEUE`

within the table `MSG_QUEUE_TABLE`.

```
BEGIN
DBMS_AQADM.CREATE_QUEUE ( queue_name => 'MSG_QUEUE',
queue_table => 'MSG_QUEUE_TABLE', comment => 'This queue contains
pending messages.');
END;
```

Starting the Queue

Once the queue is created, invoke the following SPL code at the command line to start a queue in the EDB database.

```
BEGIN
DBMS_AQADM.START_QUEUE
(queue_name => 'MSG_QUEUE');
END;
```

Client-side Example

Once you have created a user-defined type, followed by queue table and queue, start the queue. Then, you can enqueue or dequeue a message using EDB .Net drivers.

Enqueue a message:

To enqueue a message on your .NET application, you must:

1. Import the `EnterpriseDB.EDBClient` namespace.
2. Pass the name of the queue and create the instance of the `EDBAQQueue`.
3. Create the enqueue message and define a payload.
4. Call the `queue.Enqueue` method.

The following code listing demonstrates using the `queue.Enqueue` method:

Note

The following code creates the message and serializes it. This is just an

example code and is not going to compile if copied as it is. It is the responsibility of the user to serialize the message as XML.

```
using EnterpriseDB.EDBClient;
using System;
using System.Collections.Generic;
using System.Linq;
using System.Text;
using System.Threading.Tasks;

namespace AQXml
{
    class MyXML
    {
        public string value { get; set; }
    }
    class Program
    {
        static void Main(string[] args)
        {
            int messagesToSend = 1;
            if (args.Length > 0 && !string.IsNullOrEmpty(args[0]))
            {
                messagesToSend = int.Parse(args[0]);
            }
            for (int i = 0; i < 5; i++)
            {
                EnqueMsg("test message: " + i);
            }
        }

      private static EDBConnection GetConnection()
        {
            string connectionString =
"Server=127.0.0.1;Host=127.0.0.1;Port=5444;User
Id=enterprisedb;Password=test;Database=edb;Timeout=999";
```

```
        EDBConnection connection = new EDBConnection(connectionString);
        connection.Open();
        return connection;
    }


    private static string ByteArrayToString(byte[] byteArray)
    {
        // Sanity check if it's null so we don't incur overhead of an exception
        if (byteArray == null)
        {
            return string.Empty;
        }
        try
        {
            StringBuilder hex = new StringBuilder(byteArray.Length * 2);
            foreach (byte b in byteArray)
            {
                hex.AppendFormat("{0:x2}", b);
            }

            return hex.ToString().ToUpper();
        }
        catch
        {
            return string.Empty;
        }
    }

    private static bool EnqueMsg(string msg)
    {
        EDBConnection con = GetConnection();
        using (EDBAQQueue queue = new EDBAQQueue("MSG_QUEUE",
con))
        {
            queue.MessageType = EDBAQMessageType.Xml;
```

```
            EDBTransaction txn = queue.Connection.BeginTransaction();
            QueuedEntities.Message queuedMessage = new
QueuedEntities.Message() { MessageText = msg };

            try
            {
                string rootElementName = queuedMessage.GetType().Name;
                if (rootElementName.IndexOf(".") != -1)
                {
                    rootElementName = rootElementName.Split('.').Last();
                }

                string xml = new
Utils.XmlFragmentSerializer<QueuedEntities.Message>
().Serialize(queuedMessage);
                EDBAQMessage queMsg = new EDBAQMessage();
                queMsg.Payload = new MyXML { value = xml };
                queue.MessageType = EDBAQMessageType.Udt;
                queue.UdtTypeName = "myxml";
                queue.Enqueue(queMsg);
                var messageId = ByteArrayToString((byte[])queMsg.MessageId);
                Console.WriteLine("MessageID: " + messageId);
                txn.Commit();
                queMsg = null;
                xml = null;
                rootElementName = null;
                return true;
            }
            catch (Exception ex)
            {
                txn?.Rollback();
                Console.WriteLine("Failed to enqueue message.");
                Console.WriteLine(ex.ToString());
                return false;
            }
            finally
```

```
            {
                queue?.Connection?.Dispose();
            }
        }
    }

}
```

Dequeueing a message

To dequeue a message on your .NET application, you must:

1. Import the `EnterpriseDB.EDBClient` namespace.
2. Pass the name of the queue and create the instance of the `EDBAQQueue`.
3. Call the `queue.Dequeue` method.

Note

The following code creates the message and serializes it. This is just an example code and is not going to compile if copied as it is. It is the responsibility of the user to serialize the message as XML.

```
using System;
using System.Collections.Generic;
using System.Linq;
using System.Text;
using System.Threading.Tasks;
using EnterpriseDB.EDBClient;

namespace DequeueXML
{
    class MyXML
    {
        public string value { get; set; }
    }
    class Program
    {
```

```
        static void Main(string[] args)
        {
            DequeMsg();
        }


        private static EDBConnection GetConnection()
        {
            string connectionString =
"Server=127.0.0.1;Host=127.0.0.1;Port=5444;User
Id=enterprisedb;Password=test;Database=edb;Timeout=999";
            EDBConnection connection = new EDBConnection(connectionString);
            connection.Open();
            return connection;
        }


        private static string ByteArrayToString(byte[] byteArray)
        {
            // Sanity check if it's null so we don't incur overhead of an exception
            if (byteArray == null)
            {
                return string.Empty;
            }
            try
            {
                StringBuilder hex = new StringBuilder(byteArray.Length * 2);
                foreach (byte b in byteArray)
                {
                    hex.AppendFormat("{0:x2}", b);
                }

                return hex.ToString().ToUpper();
            }
            catch
            {
```

```
            return string.Empty;
        }
    }
    public static void DequeMsg(int waitTime = 10)
    {
        EDBConnection con = GetConnection();
        using (EDBAQQueue queueListen = new
EDBAQQueue("MSG_QUEUE", con))
        {
            queueListen.UdtTypeName = "myxml";
            queueListen.DequeueOptions.Navigation =
EDBAQNavigationMode.FIRST_MESSAGE;
            queueListen.DequeueOptions.Visibility =
EDBAQVisibility.ON_COMMIT;
            queueListen.DequeueOptions.Wait = 1;
            EDBTransaction txn = null;

            while (1 == 1)
                {

                if (queueListen.Connection.State ==
System.Data.ConnectionState.Closed)
                {
                    queueListen.Connection.Open();
                }

                string messageId = "Unknown";
                try
                {
                    // the listen function is a blocking function. It will Wait the
specified waitTime or until a
                    // message is received.
                    Console.WriteLine("Listening...");
                    string v = queueListen.Listen(null, waitTime);
                    // If we are waiting for a message and we specify a Wait time,
                    // then if there are no more messages, we want to just bounce
```

```
out.
                if (waitTime > -1 && v == null)
                {
                    Console.WriteLine("No message received during Wait
period.");
                    Console.WriteLine();
                    continue;
                }

                // once we're here that means a message has been detected in
the queue. Let's deal with it.
                txn = queueListen.Connection.BeginTransaction();

                Console.WriteLine("Attempting to dequeue message...");
                // dequeue the message
                EDBAQMessage deqMsg;
                try
                {
                    deqMsg = queueListen.Dequeue();
                }
                catch (Exception ex)
                {
                    if (ex.Message.Contains("ORA-25228"))
                    {
                        Console.WriteLine("Message was not there.  Another
process must have picked it up.");
                        Console.WriteLine();
                        txn.Rollback();
                        continue;
                    }
                    else
                    {
                        throw;
                    }
                }
```

```
                messageId = ByteArrayToString((byte[])deqMsg.MessageId);
                if (deqMsg != null)
                {
                    Console.WriteLine("Processing received message...");
                    // process the message payload
                    MyXML obj = new MyXML();
                    queueListen.Map<MyXML>(deqMsg.Payload, obj);

                    QueuedEntities.Message msg = new
Utils.XmlFragmentSerializer<QueuedEntities.Message>
().Deserialize(obj.value);

                    Console.WriteLine("Received Message:");
                    Console.WriteLine("MessageID: " + messageId);
                    Console.WriteLine("Message: " + msg.MessageText);
                    Console.WriteLine("Enqueue Time" +
queueListen.MessageProperties.EnqueueTime);

                    txn.Commit();

                    Console.WriteLine("Finished processing message");
                    Console.WriteLine();

                }
                else
                {
                    Console.WriteLine("Message was not dequeued.");
                }
            }
            catch (Exception ex)
            {
                Console.WriteLine("Failed To dequeue or process the
dequeued message.");
                Console.WriteLine(ex.ToString());
                Console.WriteLine();
                if (txn != null)
```

```
                {
                    txn.Rollback();
                    if (txn != null)
                    {
                        txn.Dispose();
                    }
                }
            }
        }
    }

    }
}
```

EDBAQ Classes

The following EDBAQ classes are used in this application:

EDBAQDequeueMode

The `EDBAQDequeueMode` class lists all the dequeuer modes available.

Value	Description
Browse	Read the message without locking.
Locked	Reads and gets a write lock on the message.
Remove	Deletes the message after reading. This is the default value.
Remove_NoData	Confirms receipt of the message.

EDBAQDequeueOptions

The `EDBAQDequeueOptions` class lists the options available when dequeuing a message.

Property	Description
ConsumerName	The name of the consumer for which to dequeue the message.
DequeueMode	This is set from EDBAQDequeueMode. It represents the locking behavior linked with the dequeue option.
Navigation	This is set from EDBAQNavigationMode. It represents the position of the message that will be fetched.
Visibility	This is set from EDBAQVisibility. It represents whether the new message is dequeued or not as part of the current transaction.
Wait	The wait time for a message as per the search criteria.
Msgid	The message identifier.
Correlation	The correlation identifier.
DeqCondition	The dequeuer condition. It is a Boolean expression.
Transformation	The transformation that will be applied before dequeuing the message.
DeliveryMode	The delivery mode of the dequeued message.

EDBAQEnqueueOptions

The `EDBAQEnqueueOptions` class lists the options available when enqueuing a message.

Property	Description
Visibility	This is set from EDBAQVisibility. It represents whether the new message is enqueued or not as part of the current transaction.
RelativeMsgid	The relative message identifier.
SequenceDeviation	The sequence when the message should be dequeued.
Transformation	The transformation that will be applied before enqueuing the message.
DeliveryMode	The delivery mode of the enqueued message.

EDBAQMessage

The `EDBAQMessage` class lists a message to be enqueued/dequeued.

Property	Description
Payload	The actual message to be queued.
MessageId	The ID of the queued message.

EDBAQMessageProperties

The `EDBAQMessageProperties` lists the message properties available.

Property	Description
Priority	The priority of the message.
Delay	The duration post which the message is available for dequeuing. This is specified in seconds.
Expiration	The duration for which the message is available for dequeuing. This is specified in seconds.
Correlation	The correlation identifier.
Attempts	The number of attempts taken to dequeue the message.
RecipientList	The receipients list that overthrows the default queue subscribers.
ExceptionQueue	The name of the queue where the unprocessed messages should be moved.
EnqueueTime	The time when the message was enqueued.
State	The state of the message while dequeue.
OriginalMsgid	The message identifier in the last queue.
TransactionGroup	The transaction group for the dequeued messages.
DeliveryMode	The delivery mode of the dequeued message.

EDBAQMessageState

The `EDBAQMessageState` class represents the state of the message during dequeue.

Value	Description
Expired	The message is moved to the exception queue.
Processed	The message is processed and kept.

Value	Description
Ready	The message is ready to be processed.
Waiting	The message is in waiting state. The delay is not reached.

EDBAQMessageType

The `EDBAQMessageType` class represents the types for payload.

Value	Description
Raw	The raw message type. Note: Currently, this payload type is not supported.
UDT	The user defined type message.
XML	The XML type message. Note: Currently, this payload type is not supported.

EDBAQNavigationMode

The `EDBAQNavigationMode` class represents the different types of navigation modes available.

Value	Description
First_Message	Returns the first available message that matches the search terms.
Next_Message	Returns the next available message that matches the search items.
Next_Transaction	Returns the first message of next transaction group.

EDBAQQueue

The `EDBAQQueue` class represents a SQL statement to execute `DMBS_AQ` functionality on a PostgreSQL database.

Property	Description
Connection	The connection to be used.
Name	The name of the queue.
MessageType	The message type that is enqueued/dequeued from this queue. For example EDBAQMessageType.Udt.
UdtTypeName	The user defined type name of the message type.
EnqueueOptions	The enqueue options to be used.
DequeuOptions	The dequeue options to be used.
MessageProperties	The message properties to be used.

EDBAQVisibility

The `EDBAQVisibility` class represents the visibility options available.

Value	Description
Immediate	The enqueue/dequeue is not part of the ongoing transaction.
On_Commit	The enqueue/dequeue is part of the current transaction.

Note

- To review the default options for the above parameters, click here.
- EDB Advanced Queueing functionality uses user-defined types for calling enqueue/dequeue operations. `Server Compatibility Mode=NoTypeLoading` cannot be used with Advanced Queueing because `NoTypeLoading` will not load any user-defined types.

13 Using a Ref Cursor in a .NET Application

A `ref cursor` is a cursor variable that contains a pointer to a query result set. The result set is determined by the execution of the `OPEN FOR` statement using the cursor variable. A cursor variable is not tied to a particular query like a static cursor. The same cursor variable may be opened a number of times with

the `OPEN FOR` statement containing different queries and each time, a new result set will be created for that query and made available via the cursor variable. There are two ways to declare a cursor variable:

- Use the `SYS_REFCURSOR` built-in data type to declare a weakly-typed ref cursor.
- Define a strongly-typed ref cursor that declares a variable of that type.

`SYS_REFCURSOR` is a ref cursor type that allows any result set to be associated with it. This is known as a weakly-typed ref cursor. The following example is a declaration of a weakly-typed ref cursor:

```
name SYS_REFCURSOR;
```

Following is an example of a strongly-typed ref cursor:

```
TYPE <cursor_type_name> IS REF CURSOR RETURN
emp%ROWTYPE;
```

Creating the Stored Procedure

The following sample code creates a stored procedure called `refcur_inout_callee`. To create the sample procedure, invoke EDB-PSQL and connect to the Advanced Server host database. Enter the following SPL code at the command line:

```
CREATE OR REPLACE PROCEDURE
 refcur_inout_callee(v_refcur IN OUT SYS_REFCURSOR)
IS
BEGIN
  OPEN v_refcur FOR SELECT ename FROM emp;
END;
```

To use the above defined procedure from .NET code, you must specify the data type of the ref cursor being passed as an `IN` parameter, as shown in the above script.

The following C# code uses the stored procedure to retrieve employee names from the `emp` table:

```
using System;
```

```
using System.Data;
using EnterpriseDB.EDBClient;
using System.Configuration;

namespace EDBRefCursor
{
   class EmpRefcursor
   {
      [STAThread]
      static void Main(string[] args)
      {
         string strConnectionString =
         ConfigurationManager.AppSettings["DB_CONN_STRING"];
         EDBConnection conn = new EDBConnection(strConnectionString);
         conn.Open();
         try
         {
            EDBTransaction tran = conn.BeginTransaction();
            EDBCommand command = new
EDBCommand("refcur_inout_callee",
               conn);
            command.CommandType = CommandType.StoredProcedure;
            command.Transaction = tran;
            command.Parameters.Add(new EDBParameter("refCursor",
               EDBTypes.EDBDbType.Refcursor, 10, "refCursor",

            ParameterDirection.InputOutput, false, 2, 2,
               System.Data.DataRowVersion.Current, null));

            command.Prepare();
            command.Parameters[0].Value = null;

            command.ExecuteNonQuery();
            String cursorName = command.Parameters[0].Value.ToString();
            command.CommandText = "fetch all in \"" + cursorName + "\"";
            command.CommandType = CommandType.Text;
```

```
            EDBDataReader reader =
               command.ExecuteReader(CommandBehavior.SequentialAccess);
            int fc = reader.FieldCount;
            while (reader.Read())
            {
               for (int i = 0; i < fc; i++)
               {
                  Console.WriteLine(reader.GetString(i));
               }
            }
            reader.Close();
            tran.Commit();
         }
         catch (Exception ex)
         {
            Console.WriteLine(ex.Message.ToString());
         }
      }
   }
}
```

The following .NET code snippet displays the result on the console:

```
for(int i = 0;i < fc; i++)
{
   Console.WriteLine(reader.GetString(i));
}
```

Please note that you must bind the `EDBDbType.RefCursor` type in `EDBParameter()` if you are using a ref cursor parameter.

14 Using Plugins

EDB .Net driver plugins are introduced to support the enhanced capabilities for different data types, which are otherwise not available in .Net. The different plugins available support:

- GeoJSON
- Json.NET
- Legacy PostGIS
- NetTopologySuite
- NodaTime
- Rawpostgis

The plugins support the use of spatial, data/time and Json types. The following sections detail the supported frameworks and data provider installation path for these plugins.

GeoJSON

If you are using the GeoJSON plugin on .NET Framework 4.6.1, the data provider installation path is:

```
C:\Program Files\edb\dotnet\plugins\GeoJSON\net461
```

The following shared library files are required:

```
EnterpriseDB.EDBClient.GeoJSON.dll
GeoJSON.Net.dll
Newtonsoft.Json.dll
```

If you are using the GeoJSON plugin on .NET Framework 4.7.2, the data provider installation path is:

```
C:\Program Files\edb\dotnet\plugins\GeoJSON\net472
```

The following shared library files are required:

```
EnterpriseDB.EDBClient.GeoJSON.dll
GeoJSON.Net.dll
Newtonsoft.Json.dll
```

If you are using the GeoJSON plugin on .NET Framework 4.8, the data provider

installation path is:

```
C:\Program Files\edb\dotnet\plugins\GeoJSON\net48
```

The following shared library files are required:

```
EnterpriseDB.EDBClient.GeoJSON.dll
GeoJSON.Net.dll
Newtonsoft.Json.dll
```

If you are using the GeoJSON plugin on .NET Standard 2.0, the data provider installation path is:

```
C:\Program Files\edb\dotnet\plugins\GeoJSON\netstandard2.0
```

The following shared library files are required:

```
EnterpriseDB.EDBClient.GeoJSON.dll
```

For detailed information about using the GeoJSON plugin, see the Npgsql documentation.

Json.NET

If you are using the Json.NET plugin on .NET Framework 4.6.1, the data provider installation path is:

```
C:\Program Files\edb\dotnet\plugins\Json.NET\net461
```

The following shared library files are required:

```
EnterpriseDB.EDBClient.Json.NET.dll
Newtonsoft.Json.dll
```

If you are using the Json.NET plugin on .NET Framework 4.7.2, the data provider installation path is:

```
C:\Program Files\edb\dotnet\plugins\Json.NET\net472
```

The following shared library files are required:

```
EnterpriseDB.EDBClient.Json.NET.dll
Newtonsoft.Json.dll
```

If you are using the Json.NET plugin on .NET Framework 4.8, the data provider installation path is:

```
C:\Program Files\edb\dotnet\plugins\Json.NET\net48
```

The following shared library files are required:

```
EnterpriseDB.EDBClient.Json.NET.dll
Newtonsoft.Json.dll
```

If you are using the Json.NET plugin on .NET Standard 2.0, the data provider installation path is:

```
C:\Program Files\edb\dotnet\plugins\Json.NET\netstandard2.0
```

The following shared library files are required:

```
EnterpriseDB.EDBClient.Json.NET.dll
```

For detailed information about using the Json.NET plugin, see the Npgsql documentation.

LegacyPostGIS

If you are using the LegacyPostGIS plugin on .Net Framework 4.6.1, the data provider installation path is:

```
C:\Program Files\edb\dotnet\plugins\LegacyPostgis\net461
```

The following shared library files are required:

```
EnterpriseDB.EDBClient.LegacyPostgis.dll
```

If you are using the LegacyPostGIS plugin on .Net Framework 4.7.2, the data provider installation path is:

```
C:\Program Files\edb\dotnet\plugins\LegacyPostgis\net472
```

The following shared library files are required:

```
EnterpriseDB.EDBClient.LegacyPostgis.dll
```

If you are using the LegacyPostGIS plugin on .Net Framework 4.8, the data provider installation path is:

```
C:\Program Files\edb\dotnet\plugins\LegacyPostgis\net48
```

The following shared library files are required:

```
EnterpriseDB.EDBClient.LegacyPostgis.dll
```

If you are using the LegacyPostGIS plugin on .Net Standard 2.0, the data provider installation path is:

```
C:\Program Files\edb\dotnet\plugins\LegacyPostgis\netstandard2.0
```

The following shared library files are required:

```
EnterpriseDB.EDBClient.LegacyPostgis.dll
```

For detailed information about using the LegacyPostGIS plugin, see the Npgsql documentation.

NetTopologySuite

If you are using the NetTopologySuite plugin on .Net Framework 4.6.1, the data provider installation path is:

```
C:\Program Files\edb\dotnet\plugins\NetTopologySuite\net461
```

The following shared library files are required:

```
EnterpriseDB.EDBClient.NetTopologySuite.dll
NetTopologySuite.dll
NetTopologySuite.IO.PostGis.dll
```

If you are using the NetTopologySuite plugin on .Net Framework 4.7.2, the data provider installation path is:

```
C:\Program Files\edb\dotnet\plugins\NetTopologySuite\net472
```

The following shared library files are required:

```
EnterpriseDB.EDBClient.NetTopologySuite.dll
GeoAPI.dll
NetTopologySuite.dll
NetTopologySuite.IO.PostGis.dll
```

If you are using the NetTopologySuite plugin on .Net Framework 4.8, the data provider installation path is:

```
C:\Program Files\edb\dotnet\plugins\NetTopologySuite\net48
```

The following shared library files are required:

```
EnterpriseDB.EDBClient.NetTopologySuite.dll
GeoAPI.dll
NetTopologySuite.dll
NetTopologySuite.IO.PostGis.dll
```

If you are using the NetTopologySuite plugin on .Net Standard 2.0, the data provider installation path is:

```
C:\Program Files\edb\dotnet\plugins\NetTopologySuite\netstandard2.0
```

The following shared library files are required:

```
EnterpriseDB.EDBClient.NetTopologySuite.dll
```

For detailed information about using the NetTopologySuite type plugin, see the Npgsql documentation.

NodaTime

If you are using the NodaTime plugin on .Net Framework 4.6.1, the data provider installation path is:

```
C:\Program Files\edb\dotnet\plugins\NodaTime\net461
```

The following shared library files are required:

```
EnterpriseDB.EDBClient.NodaTime.dll
NodaTime.dll
```

If you are using the NodaTime plugin on .Net Framework 4.7.2, the data provider installation path is:

```
C:\Program Files\edb\dotnet\plugins\NodaTime\net472
```

The following shared library files are required:

```
EnterpriseDB.EDBClient.NodaTime.dll
NodaTime.dll
```

If you are using the NodaTime plugin on .Net Framework 4.8, the data provider installation path is:

```
C:\Program Files\edb\dotnet\plugins\NodaTime\net48
```

The following shared library files are required:

```
EnterpriseDB.EDBClient.NodaTime.dll
NodaTime.dll
```

If you are using the NodaTime plugin on .Net Standard 2.0, the data provider installation path is:

```
C:\Program Files\edb\dotnet\plugins\NodaTime\netstandard2.0
```

The following shared library files are required:

```
EnterpriseDB.EDBClient.NodaTime.dll
```

For detailed information about using the NodaTime plugin, see the Npgsql documentation.

RawPostGIS

If you are using the RawPostGIS plugin on .Net Framework 4.6.1, the data

provider installation path is:

```
C:\Program Files\edb\dotnet\plugins\RawPostgis\net461
```

The following shared library files are required:

```
EnterpriseDB.EDBClient.RawPostgis.dll
```

If you are using the RawPostGIS plugin on .Net Framework 4.7.2, the data provider installation path is:

```
C:\Program Files\edb\dotnet\plugins\RawPostgis\net472
```

The following shared library files are required:

```
EnterpriseDB.EDBClient.RawPostgis.dll
```

If you are using the RawPostGIS plugin on .Net Framework 4.8, the data provider installation path is:

```
C:\Program Files\edb\dotnet\plugins\RawPostgis\net48
```

The following shared library files are required:

```
EnterpriseDB.EDBClient.RawPostgis.dll
```

If you are using the RawPostGIS type plugin on .Net Standard 2.0, the data provider installation path is:

```
C:\Program\Files\edb\dotnet\plugins\RawPostGis\netstandard2.0
```

The following shared library files are required:

```
EnterpriseDB.EDBClient.RawPostgis.dll
```

For detailed information about using the RawPostGIS plugin, see the documentation.

15 Using Object Types in .NET

The SQL `CREATE TYPE` command is used to create a user-defined `object type`, which is stored in the Advanced Server database.

These user-defined types can then be referenced within SPL procedures, SPL functions, and .NET programs.

The basic object type is created with the `CREATE TYPE AS OBJECT` command along with optional usage of the `CREATE TYPE BODY` command.

An example that demonstrates using an object type is shown in the following section.

Using an Object Type

To use an object type, you must first create the object type in the Advanced Server database. Object type `addr_object_type` defines the attributes of an address:

```
CREATE OR REPLACE TYPE addr_object_type AS OBJECT
(
   street         VARCHAR2(30),
   city           VARCHAR2(20),
   state          CHAR(2),
   zip            NUMBER(5)
);
```

Object type `emp_obj_typ` defines the attributes of an employee. Note that one of these attributes is object type `ADDR_OBJECT_TYPE` as previously described. The object type body contains a method that displays the employee information:

```
CREATE OR REPLACE TYPE emp_obj_typ AS OBJECT
(
   empno          NUMBER(4),
```

```
   ename          VARCHAR2(20),
   addr           ADDR_OBJECT_TYPE,
   MEMBER PROCEDURE display_emp(SELF IN OUT emp_obj_typ)
);

CREATE OR REPLACE TYPE BODY emp_obj_typ AS
 MEMBER PROCEDURE display_emp (SELF IN OUT emp_obj_typ)
 IS
 BEGIN
   DBMS_OUTPUT.PUT_LINE('Employee No   : ' || SELF.empno);
   DBMS_OUTPUT.PUT_LINE('Name          : ' || SELF.ename);
   DBMS_OUTPUT.PUT_LINE('Street        : ' || SELF.addr.street);
   DBMS_OUTPUT.PUT_LINE('City/State/Zip: ' || SELF.addr.city || ', ' ||
     SELF.addr.state || ' ' || LPAD(SELF.addr.zip,5,'0'));
 END;
END;
```

The following listing is a complete .NET program that uses these user-defined object types:

```
namespace ObjectTypesSample
{
   class Program
   {
      static void Main(string[] args)
      {
         EDBConnection.GlobalTypeMapper.MapComposite<addr_object_type>
("enterprisedb.addr_object_type");
         EDBConnection.GlobalTypeMapper.MapComposite<emp_obj_typ>
("enterprisedb.emp_obj_typ");
         EDBConnection conn = new
EDBConnection("Server=localhost;Port=5444;database=test;User
ID=enterprisedb;password=<PASSWORD>;");

         try
         {
```

```
            conn.Open();

            EDBCommand cmd = new
EDBCommand("emp_obj_typ.display_emp", conn);

            cmd.CommandType =
System.Data.CommandType.StoredProcedure;
            EDBCommandBuilder.DeriveParameters(cmd);

            addr_object_type address = new addr_object_type()
            {
               street = "123 MAIN STREET",
               city = "EDISON",
               state = "NJ",
               zip = 8817
            };

            emp_obj_typ emp = new emp_obj_typ()
            {
               empno = 9001,
               ename = "JONES",
               addr = address
            };
            cmd.Parameters[0].Value = emp;
            cmd.Prepare();
            cmd.ExecuteNonQuery();

            emp_obj_typ empOut = (emp_obj_typ)cmd.Parameters[0].Value;
            Console.WriteLine("Emp No: " + empOut.empno);
            Console.WriteLine("Emp Name: " + empOut.ename);
            Console.WriteLine("Emp Address Street: " + empOut.addr.street);
            Console.WriteLine("Emp Address City: " + empOut.addr.city);
            Console.WriteLine("Emp Address State: " + empOut.addr.state);
            Console.WriteLine("Emp Address Zip: " + empOut.addr.zip);
            Console.WriteLine("Emp No: " + empOut.empno);
        }
```

```
            catch (EDBException exp)
            {
                Console.WriteLine(exp.Message.ToString());
            }
            finally
            {
                conn.Close();
            }
        }
    }

    public class addr_object_type
    {
        public string street;
        public string city;
        public string state;
        public decimal zip;
    }

    public class emp_obj_typ
    {
        public decimal empno;
        public string ename;
        public addr_object_type addr;
    }
}
```

The following .NET types are defined to map to the types in Advanced Server:

```
public class addr_object_type
{
    public string street;
    public string city;
    public string state;
    public decimal zip;
}
```

```
public class emp_obj_typ
{
    public decimal empno;
    public string ename;
    public addr_object_type addr;
}
```

A call to `EDBConnection.GlobalTypeMapper.MapComposite` maps the .NET type to the Advanced Server types:

```
EDBConnection.GlobalTypeMapper.MapComposite<addr_object_type>
("enterprisedb.addr_object_type");
  EDBConnection.GlobalTypeMapper.MapComposite<emp_obj_typ>
("enterprisedb.emp_obj_typ");
```

A call to `EDBCommandBuilder.DeriveParameters()` gets parameter information for a stored procedure. This allows you to just set the parameter values and call the stored procedure:

```
EDBCommandBuilder.DeriveParameters(cmd);
```

The value of the parameter is set by creating an object of the .NET type and assigning it to the `Value` property of the parameter:

```
addr_object_type address = new addr_object_type()
{
    street = "123 MAIN STREET",
    city = "EDISON",
    state = "NJ",
    zip = 8817
};

emp_obj_typ emp = new emp_obj_typ()
{
    empno = 9001,
    ename = "JONES",
```

```
    addr = address
};
cmd.Parameters[0].Value = emp;
```

A call to `cmd.ExecuteNonQuery()` executes the call to the `display_emp()` method:

```
cmd.ExecuteNonQuery();
```

16 Security and Encryption

16.1 Scram Compatibility

The EDB .NET driver provides SCRAM-SHA-256 support for Advanced Server version 10 and above. This support is available from EDB .NET 4.0.2.1 release onwards.

17 EDB .NET Connector Logging

EDB .NET Connector supports the use of logging to help resolve issues with the .NET Connector when used in your application. The connector uses classes in the `EnterpriseDB.EDBClient.Logging` namespace for logging.

Console Logging to Standard Error

`EnterpriseDB.EDBClient.Logging.ConsoleLoggingProvider` is a class that outputs error messages to `STDERR`. To use this class, include the following line in your application before using any of the Advanced Server .NET Connector APIs.

```
EnterpriseDB.EDBClient.Logging.EDBLogManager.Provider = new
EnterpriseDB.EDBClient.Logging.ConsoleLoggingProvider(EDBLogLevel.Debug,
true, true);
```

The following log levels are available:

- Trace
- Debug
- Info
- Warn
- Error
- Fatal

Writing a Custom Logger

If the console logging provider does not fulfill your requirements, you can write a custom logger by implementing the `EnterpriseDB.EDBClient.Logging.IEDBLoggingProvider` interface, and extending the `EnterpriseDB.EDBClient.Logging.EDBLogger` class, for instance, writing your logs to a file. The following is a simple example of how to write a custom logger:

```
public class MyLoggingProvider : IEDBLoggingProvider
   {
       string _logFile;
       readonly EDBLogLevel _minLevel;
       readonly bool _printLevel;
       readonly bool _printConnectorId;

       public MyLoggingProvider(string logFile, EDBLogLevel minLevel =
EDBLogLevel.Info, bool printLevel = false, bool printConnectorId = false)
       {
           _logFile = logFile;
           _minLevel = minLevel;
           _printLevel = printLevel;
```

```
            _printConnectorId = printConnectorId;
        }

        public EDBLogger CreateLogger(string name)
        {
            return new MyLogger(_logFile, _minLevel, _printLevel,
_printConnectorId);
        }
    }

 class MyLogger : EDBLogger
    {
        string _logFile;
        readonly EDBLogLevel _minLevel;
        readonly bool _printLevel;
        readonly bool _printConnectorId;

        internal MyLogger(string logFile, EDBLogLevel minLevel, bool printLevel,
bool printConnectorId)
        {
            _logFile = logFile;
            _minLevel = minLevel;
            _printLevel = printLevel;
            _printConnectorId = printConnectorId;
        }

        public override bool IsEnabled(EDBLogLevel level) => level >= _minLevel;

        public override void Log(EDBLogLevel level, int connectorId, string msg,
Exception exception = null)
        {
            if (!IsEnabled(level))
                return;



            using (StreamWriter writer = new StreamWriter(_logFile, true))
```

```
        {
            var sb = new StringBuilder();
            if (_printLevel)
            {
                sb.Append(level.ToString().ToUpper());
                sb.Append(' ');
            }

            if (_printConnectorId && connectorId != 0)
            {
                sb.Append("[");
                sb.Append(connectorId);
                sb.Append("] ");
            }

            sb.AppendLine(msg);

            if (exception != null)
                sb.AppendLine(exception.ToString());

            writer.Write(sb.ToString());
        }

    }
}
```

To use this custom logger, put the following line in your application before using any of the EDB .NET Connector APIs:

```
EDBLogManager.Provider = new MyLoggingProvider(filepath,
EDBLogLevel.Debug, true, true);
```

18 API Reference

For information about using the API, see the Npgsql documentation.

Usage notes:

- When using the API, replace references to `Npgsql` with `EnterpriseDB.EDBClient`.
- When referring to classes, replace `Npgsql` with `EDB`. For example, use the `EDBBinaryExporter` class instead of the `NpgsqlBinaryExporter` class.