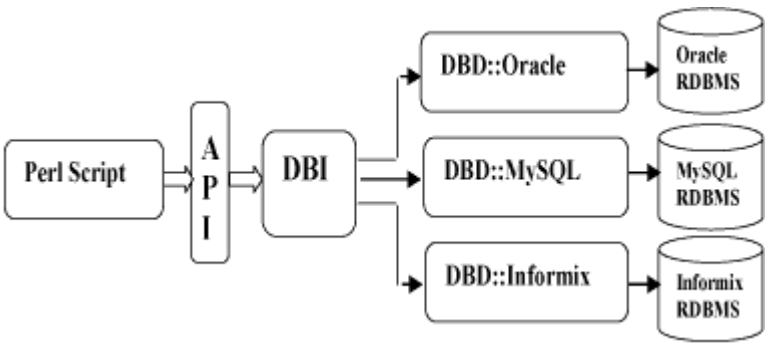
Perl - Database Access

Perl has become very easy to write database applications using **DBI** module. DBI stands for **Database Independent Interface** for Perl, which means DBI provides an abstraction layer between the Perl code and the underlying database, allowing you to switch database implementations really easily.

The DBI is a database access module for the Perl programming language. It provides a set of methods, variables, and conventions that provide a consistent database interface, independent of the actual database being used.

Architecture of a DBI Application

DBI is independent of any database available in backend. You can use DBI whether you are working with Oracle, MySQL or Informix, etc. This is clear from the following architecture diagram.



Here DBI is responsible of taking all SQL commands through the API, (i.e., Application Programming Interface) and to dispatch them to the appropriate driver for actual execution. And finally, DBI is responsible of taking results from the driver and giving back it to the calling script.

Notation and Conventions

Throughout this chapter following notations will be used and it is recommended that you should also follow the same convention.

$dsn Database source name
$dbh Database handle object
$sth Statement handle object
$h Any of the handle types above ($dbh, $sth, or $drh)
$rc General Return Code (boolean: true=ok, false=error)
$rv General Return Value (typically an integer)
@ary List of values returned from the database.
$rows Number of rows processed (if available, else -1)
$fh A filehandle
undef NULL values are represented by undefined values in Perl
\%attr Reference to a hash of attribute values passed to methods

Database Connection

Assuming we are going to work with MySQL database. Before connecting to a database make sure of the followings. You can take help of our MySQL tutorial in case you are not aware about how to create database and tables in MySQL database.

- You have created a database with a name TESTDB.
- You have created a table with a name TEST_TABLE in TESTDB.
- This table is having fields FIRST_NAME, LAST_NAME, AGE, SEX and INCOME.
- User ID "testuser" and password "test123" are set to access TESTDB.
- Perl Module DBI is installed properly on your machine.
- You have gone through MySQL tutorial to understand MySQL Basics.

Following is the example of connecting with MySQL database "TESTDB" −

```
#!/usr/bin/perl

use DBI
use strict;

my $driver = "mysql";
my $database = "TESTDB";
my $dsn = "DBI:$driver:database=$database";
my $userid = "testuser";
my $password = "test123";

my $dbh = DBI->connect($dsn, $userid, $password ) or die $DBI::errstr;
```

If a connection is established with the datasource then a Database Handle is returned and saved into $dbh for further use otherwise $dbh is set to *undef* value and $DBI::errstr returns an error string.

INSERT Operation

INSERT operation is required when you want to create some records into a table. Here we are using table TEST_TABLE to create our records. So once our database connection is established, we are ready to create records into TEST_TABLE. Following is the procedure to create single record into TEST_TABLE. You can create as many as records you like using the same concept.

Record creation takes the following steps −

- Preparing SQL statement with INSERT statement. This will be done using **prepare()** API.
- Executing SQL query to select all the results from the database. This will be done using **execute()** API.
- Releasing Stattement handle. This will be done using **finish()** API.
- If everything goes fine then **commit** this operation otherwise you can **rollback** complete transaction. Commit and Rollback are explained in next sections.

```
my $sth = $dbh->prepare("INSERT INTO TEST_TABLE
                        (FIRST_NAME, LAST_NAME, SEX, AGE, INCOME )
                          values
                        ('john', 'poul', 'M', 30, 13000)");
```

```
$sth->execute() or die $DBI::errstr;
$sth->finish();
$dbh->commit or die $DBI::errstr;
```

Using Bind Values

There may be a case when values to be entered is not given in advance. So you can use bind variables which will take the required values at run time. Perl DBI modules make use of a question mark in place of actual value and then actual values are passed through execute() API at the run time. Following is the example −

```
my $first_name = "john";
my $last_name = "poul";
my $sex = "M";
my $income = 13000;
my $age = 30;
my $sth = $dbh->prepare("INSERT INTO TEST_TABLE
                    (FIRST_NAME, LAST_NAME, SEX, AGE, INCOME )
                      values
                    (?,?,?,?,?)");
$sth->execute($first_name,$last_name,$sex, $age, $income)
        or die $DBI::errstr;
$sth->finish();
$dbh->commit or die $DBI::errstr;
```

READ Operation

READ Operation on any databasse means to fetch some useful information from the database, i.e., one or more records from one or more tables. So once our database connection is established, we are ready to make a query into this database. Following is the procedure to query all the records having AGE greater than 20. This will take four steps −

- Preparing SQL SELECT query based on required conditions. This will be done using **prepare()** API.
- Executing SQL query to select all the results from the database. This will be done using **execute()** API.
- Fetching all the results one by one and printing those results.This will be done using **fetchrow_array()** API.
- Releasing Stattement handle. This will be done using **finish()** API.

```
my $sth = $dbh->prepare("SELECT FIRST_NAME, LAST_NAME
                    FROM TEST_TABLE
                    WHERE AGE > 20");
$sth->execute() or die $DBI::errstr;
print "Number of rows found :" + $sth->rows;
while (my @row = $sth->fetchrow_array()) {
```

```
   my ($first_name, $last_name ) = @row;
   print "First Name = $first_name, Last Name = $last_name\n";
}
$sth->finish();
```

Using Bind Values

There may be a case when condition is not given in advance. So you can use bind variables, which will take the required values at run time. Perl DBI modules makes use of a question mark in place of actual value and then the actual values are passed through execute() API at the run time. Following is the example −

```
$age = 20;
my $sth = $dbh->prepare("SELECT FIRST_NAME, LAST_NAME
                         FROM TEST_TABLE
                         WHERE AGE > ?");
$sth->execute( $age ) or die $DBI::errstr;
print "Number of rows found :" + $sth->rows;
while (my @row = $sth->fetchrow_array()) {
   my ($first_name, $last_name ) = @row;
   print "First Name = $first_name, Last Name = $last_name\n";
}
$sth->finish();
```

UPDATE Operation

UPDATE Operation on any database means to update one or more records already available in the database tables. Following is the procedure to update all the records having SEX as 'M'. Here we will increase AGE of all the males by one year. This will take three steps −

- Preparing SQL query based on required conditions. This will be done using **prepare()** API.
- Executing SQL query to select all the results from the database. This will be done using **execute()** API.
- Releasing Stattement handle. This will be done using **finish()** API.
- If everything goes fine then **commit** this operation otherwise you can **rollback** complete transaction. See next section for commit and rollback APIs.

```
my $sth = $dbh->prepare("UPDATE TEST_TABLE
                         SET   AGE = AGE + 1
                         WHERE SEX = 'M'");
$sth->execute() or die $DBI::errstr;
print "Number of rows updated :" + $sth->rows;
$sth->finish();
$dbh->commit or die $DBI::errstr;
```

Using Bind Values

There may be a case when condition is not given in advance. So you can use bind variables, which will take required values at run time. Perl DBI modules make use of a question mark in place of actual value and then the actual values are passed through execute() API at the run time. Following is the example −

```
$sex = 'M';
my $sth = $dbh->prepare("UPDATE TEST_TABLE
                         SET   AGE = AGE + 1
                         WHERE SEX = ?");
$sth->execute('$sex') or die $DBI::errstr;
print "Number of rows updated :" + $sth->rows;
$sth->finish();
$dbh->commit or die $DBI::errstr;
```

In some case you would like to set a value, which is not given in advance so you can use binding value as follows. In this example income of all males will be set to 10000.

```
$sex = 'M';
$income = 10000;
my $sth = $dbh->prepare("UPDATE TEST_TABLE
                         SET   INCOME = ?
                         WHERE SEX = ?");
$sth->execute( $income, '$sex') or die $DBI::errstr;
print "Number of rows updated :" + $sth->rows;
$sth->finish();
```

DELETE Operation

DELETE operation is required when you want to delete some records from your database. Following is the procedure to delete all the records from TEST_TABLE where AGE is equal to 30. This operation will take the following steps.

- Preparing SQL query based on required conditions. This will be done using **prepare()** API.
- Executing SQL query to delete required records from the database. This will be done using **execute()** API.
- Releasing Stattement handle. This will be done using **finish ()** API.
- If everything goes fine then **commit** this operation otherwise you can **rollback** complete transaction.

```
$age = 30;
my $sth = $dbh->prepare("DELETE FROM TEST_TABLE
                         WHERE AGE = ?");
$sth->execute( $age ) or die $DBI::errstr;
print "Number of rows deleted :" + $sth->rows;
$sth->finish();
$dbh->commit or die $DBI::errstr;
```

Using do Statement

If you're doing an UPDATE, INSERT, or DELETE there is no data that comes back from the database, so there is a short cut to perform this operation. You can use **do** statement to execute any of the command as follows.

```
$dbh->do('DELETE FROM TEST_TABLE WHERE age =30');
```

do returns a true value if it succeeded, and a false value if it failed. Actually, if it succeeds it returns the number of affected rows. In the example it would return the number of rows that were actually deleted.

COMMIT Operation

Commit is the operation which gives a green signal to database to finalize the changes and after this operation no change can be reverted to its orignal position.

Here is a simple example to call **commit** API.

```
$dbh->commit or die $dbh->errstr;
```

ROLLBACK Operation

If you are not satisfied with all the changes or you encounter an error in between of any operation , you can revert those changes to use **rollback** API.

Here is a simple example to call **rollback** API.

```
$dbh->rollback or die $dbh->errstr;
```

Begin Transaction

Many databases support transactions. This means that you can make a whole bunch of queries which would modify the databases, but none of the changes are actually made. Then at the end, you issue the special SQL query **COMMIT**, and all the changes are made simultaneously. Alternatively, you can issue the query ROLLBACK, in which case all the changes are thrown away and database remains unchanged.

Perl DBI module provided **begin_work** API, which enables transactions (by turning AutoCommit off) until the next call to commit or rollback. After the next commit or rollback, AutoCommit will automatically be turned on again.

```
$rc  = $dbh->begin_work  or die $dbh->errstr;
```

AutoCommit Option

If your transactions are simple, you can save yourself the trouble of having to issue a lot of commits. When you make the connect call, you can specify an **AutoCommit** option which will perform an automatic commit operation after every successful query. Here's what it looks like −

```
my $dbh = DBI->connect($dsn, $userid, $password,
           {AutoCommit => 1})
           or die $DBI::errstr;
```

Here AutoCommit can take value 1 or 0, where 1 means AutoCommit is on and 0 means AutoCommit is off.

Automatic Error Handling

When you make the connect call, you can specify a RaiseErrors option that handles errors for you automatically. When an error occurs, DBI will abort your program instead of returning a failure code. If all you want is to abort the program on an error, this can be convenient. Here's what it looks like −

```
my $dbh = DBI->connect($dsn, $userid, $password,
          {RaiseError => 1})
          or die $DBI::errstr;
```

Here RaiseError can take value 1 or 0.

Disconnecting Database

To disconnect Database connection, use **disconnect** API as follows −

```
$rc = $dbh->disconnect  or warn $dbh->errstr;
```

The transaction behaviour of the disconnect method is, sadly, undefined. Some database systems (such as Oracle and Ingres) will automatically commit any outstanding changes, but others (such as Informix) will rollback any outstanding changes. Applications not using AutoCommit should explicitly call commit or rollback before calling disconnect.