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Best practices

Deploying IBM DB2 Express-C with PHP on Ubuntu Linux

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Executive summary

The goal of this document is to provide a step-by-step approach to installing and configuring IBM DB2 Express-C software (DB2 Express-C), PHP Hypertext Preprocessor, and Apache HTTP Server on the Ubuntu Linux operating system (Ubuntu).

In this document, you use the popular Advanced Packaging Tool (APT) package management system to download, install, and configure the necessary software components. APT is the recommended system for managing software installations on Ubuntu, greatly simplifying all aspects of software package management.

The document explains how to install the Apache 2 HTTP Server with built-in PHP 5 support. The installation of the `ibm_db2` extension for PHP is covered. You use the PEAR `pec1` utility to download and recompile the PHP module to enable support for the `ibm_db2` PECL extension.

Downloading and installing DB2 Express-C 9.7 Fix Pack 4 is covered at length. The instructions include the setup of a default DB2 instance and creation of a sample database for testing. Sample PHP scripts are provided to test the connections to the web server and to retrieve data from the sample database.

After completing all the steps, you will have a fully functioning PHP web application server with DB2 Express-C as the back-end data server.

Introduction

You can deploy IBM DB2 database servers that use the PHP programming language and Apache HTTP Server to develop and serve up dynamic web pages. This best practices paper provides the installation and configuration instructions for IBM DB2 Express-C on an Ubuntu operating system, with the Apache HTTP Server and PHP.

IBM DB2 Express-C is based on the proven core technology of DB2 for Linux, UNIX, and Windows but is free to download, use, and redistribute. DB2 Express-C is simple, flexible, powerful, and reliable. It is ideal for small businesses, developers, instructors, and students. DB2 Express-C offers the following features:

- Support for Linux, Windows, Solaris, and Mac operating systems.
- Efficient management of both relational and XML data.
- Self-management capabilities and automatic performance optimization
- A solid base for building and deploying various types of websites and applications that use relational database data. You can develop the websites and applications by using PHP, C/C++, Java™, .NET®, Ruby on Rails, Python, and other programming languages.
- Full interoperability with other DB2 editions.
- An optional low-cost offering that includes higher resource limits, 24x7 IBM customer support, and additional features including high availability clustering and replication.

The Ubuntu operating system is one of the most popular and fastest-growing open source operating systems on the market today. This operating system is available to organizations and individuals on servers, desktops, laptops, and netbook computers.

PHP Hypertext Preprocessor is an interpreted programming language that is primarily intended for the development of web applications. PHP is popular for web application development because of its focus on performance, portability, and ease of use.

The Apache HTTP Server provides secure, efficient, and extensible HTTP services that conform to current HTTP standards. Apache HTTP Server has been the most popular open source web server on the Internet since April 1996 and is maintained by the Apache HTTP Server Project.

As with DB2 Express-C, you can obtain and deploy the Ubuntu operating system, PHP, and the Apache HTTP Server free of charge.

A significant number of websites on the Internet use PHP with the Apache Server. Adding DB2 Express-C on the Ubuntu operating system to PHP and the Apache Server creates a powerful combination of technologies for building dynamic data-driven sites and applications.

DB2 Express-C server requirements

Software Requirements

In this paper, the following software stack is used to deploy database-driven dynamic web pages:

- DB2 Express-C Version 9.7 Fix Pack 4
- PHP 5
- Ubuntu 10.04 Long Term Support (LTS)
- Apache HTTP Server Version 2.0



DB2 Express-C supports only the LTS versions of the Ubuntu operating system.

Hardware Requirements

You can run DB2 Express-C on any size of system with any number of processors and amount of memory. However, DB2 Express-C limits total resource utilization as follows:

- Processor: Two cores
- Memory: 2 GB

Disk requirements

The disk space that you require for DB2 Express-C depends on the type of installation that you choose and the type of file system that you have. The DB2 Setup wizard provides size estimates that are based on the components that you select during a typical, compact, or custom installation.

Remember to include disk space for other software, including communication products, and databases.

Memory requirements

Memory requirements are affected by the size and complexity of your database system, the extent of database activity, and the number of clients accessing your system. At a minimum, a DB2 database system requires 256 MB of RAM. For a system running just a DB2 product and the DB2 GUI tools, a minimum of 512 MB of RAM is required. However, 1 GB of RAM is recommended for improved performance. These requirements do not include any additional memory requirements for other software that is running on your system.

You must enable paging, also called swap, for the DB2 database server. A reasonable minimum amount of swap or paging space for most systems is 25% - 50% of RAM. You might require additional swap or paging space to provision for unanticipated memory over commitment.

Preparing your operating system

Before you begin, ensure that you are running Ubuntu 10.04 LTS (Long-term support). To download and install Ubuntu 10.04 LTS, please visit the Ubuntu website at <http://www.ubuntu.com/download/server/download>. Follow the steps to download the software, create a CD or bootable USB stick, and start the installation. The Ubuntu installer will guide you through the installation process.

Updating software repositories



The Advanced Packaging Tool (APT) package management system will be used to download and install DB2 Express-C, Apache, and the associated PHP libraries and tools.

To ensure that all packages are available, add the Canonical Partner Repository for Ubuntu to the `/etc/apt/sources.list` file, and update your repositories with the most recent package lists. The Canonical Partner Repository for Ubuntu contains the DB2 Express-C package.



1. Add the Canonical Partner Repository:

Edit the `/etc/apt/sources.list` file:

```
sudo vi /etc/apt/sources.list
```

Ensure that the following lines exist in the file and are not commented out:

```
deb http://archive.canonical.com/ubuntu lucid partner
deb-src http://archive.canonical.com/ubuntu lucid partner
```

Comments are represented by the number sign (#) character. To uncomment lines, remove this character. If the lines do not exist, add them anywhere in the file.



2. To update the repositories with the most recent package lists, issue the following command:

```
sudo apt-get update
```

The update might take several minutes. After the update is complete, the APT utility has access to the latest packages that are required to install and configure DB2 Express-C with Apache and PHP.

Setting up Apache and PHP

Use the following steps to set up the Apache HTTP server with PHP support. If Apache and PHP are already working on your system, you can skip this section.

1. Download and install Apache and PHP by issuing the **apt-get** command:

```
sudo apt-get install apache2  
sudo apt-get install php5
```

2. Restart the Apache HTTP Server by issuing the following command:

```
sudo /etc/init.d/apache2 restart
```

The restart is required for the Apache HTTP Server to load the php5 Apache module. The php5 Apache module is required for executing embedded PHP scripts within web pages.

3. Verify that your Apache HTTP Server is working by pointing your web browser to the host name or IP address of your web server. If the server is working, an “It works” page is typically displayed. Otherwise, an error message is displayed.
4. Validate that PHP is working by using a simple PHP script:
 - a. Copy the contents of the following PHP script into the `/var/www/index.php` file. Create the file if it does not exist. The default location for web content, also known as DocumentRoot, is the `/var/www/` directory. You need root access to create and write to files in `/var/www`.

```
index.php
<html>
<head>
  <title>PHP Test</title>
</head>
  <body>
    <?php echo "PHP Works!!!" ?>
  </body>
</html>
```

- b. Remove or rename any `index.html` or `index.htm` files in the `/var/www/` path so that `index.php` is used as the default web page.
- c. Refresh your browser window. If PHP is working, "PHP Works!!!" is displayed.

Setting up DB2 Express-C

Use the APT utility to download and install DB2 Express-C. Then, create the SAMPLE database to test the connection with a SQL query.

1. Download, install, and configure DB2 Express-C Version 9.7 with the latest fix pack by using the APT package manager. DB2 Version 9.7 Fix Pack 4 was the latest offering at the time that this paper was written.

Issue the following command to download and install DB2 Express-C:

```
sudo apt-get install db2exc
```

This command creates the default DB2 database user `db2inst1` and starts the DB2 server.

2. Validate the installation of DB2 Express-C:

- a. Log in to the `db2inst1` account:

```
sudo su db2inst1
```

- b. Create the SAMPLE database by issuing the following command:

```
db2samp1
```

- c. Activate your database so that applications do not have to wait for the database manager to start the database:

```
db2 activate db sample
```



- d. Connect to the database and execute a simple SELECT statement:

```
db2 connect to SAMPLE
db2 "SELECT * FROM EMP"
```

If DB2 Express-C is installed and configured correctly, the SELECT statement returns a result set from the EMP table.

3. Set the db2inst1 password so that PHP can connect to the SAMPLE database:
 - a. Log in as root:

```
sudo su
```

- b. Change the db2inst1 password by issuing the following command and entering the new password when prompted.

```
passwd db2inst1
```

- c. Exit from the root account:

```
exit
```

Integrating PHP and DB2 Express-C

You must configure PHP so that it can communicate with DB2 Express-C. The `ibm_db2 PECL` extension enables PHP to connect to a DB2 Express-C database by using the DB2 Call Level Interface (DB2 CLI). Before you can use the `ibm_db2 PECL` extension, you must install the PHP PEAR software. PEAR provides the `pec1` utility, which is required to download and install PECL extensions such as `ibm_db2`.

1. Download the PHP PEAR software, including the `pec1` utility, by issuing the following `apt-get` command:

```
sudo apt-get install php-pear
```

2. In order for PHP to load the `ibm_db2 PECL` extension, the `pec1` utility needs to recompile PHP with `ibm_db2` support. This requires the `php5-dev` package to be installed before installing the `ibm_db2 PECL` extension.

Install the `php5-dev` module before installing the `ibm_db2 PECL` extension by issuing the following command:

```
sudo apt-get install php5-dev
```

3. Install the `ibm_db2 PECL` extension:

```
sudo pecl install ibm_db2
```

You are prompted for the DB2 database server installation directory. For the installation performed in this paper, the directory is `/home/db2inst1/sql1lib`. Substitute the appropriate directory for your DB2 database instance. Enter the directory and press Enter to continue. PHP has now been recompiled with `ibm_db2` support.

4. In the `/etc/php5/apache2/conf.d` directory, create a file called `ibm_db2.ini`. This file is required for Apache to load the `ibm_db2` PECL extension. You must have root permission to write this file.

Add the following line to the file and save your changes:

```
extension=ibm_db2.so
```

5. To have the changes take effect, restart the Apache web server by issuing the following command:

```
sudo /etc/init.d/apache2 restart
```

For detailed information about the `ibm_db2` PECL extension, including detailed configuration information and a comprehensive list of APIs for interfacing with DB2 Express-C databases, see the `ibm_db2` online documentation on the following website: http://ca.php.net/ibm_db2.

Testing the PHP to DB2 connection

To validate the configuration, you can use a simple PHP application that uses the `ibm_db2` PECL extension library to connect to the DB2 SAMPLE database.

1. As root, in the `/var/www` directory, create the `testdb2.php` file.

```
sudo vi /var/www/testdb2.php
```

2. Copy the contents of the following PHP script to the `/var/www/testdb2.php` file, updating the file to match the user ID and password for your SAMPLE database:

```
<head><title>DB2 and PHP Sample</title></head>

<body>

<?php
$database = 'SAMPLE';
$user = 'db2inst1';
$password = 'db2inst1';

$conn = db2_connect($database, $user, $password);

if ($conn) {
    echo "<h2>Employee Names</h2>\n";

    $sql = "SELECT * FROM DB2INST1.EMP";
    $stmt = db2_exec($conn, $sql, array('cursor' => DB2_SCROLLABLE));
    print("<table>\n");
    print("<tr><th>First</th><th>Middle</th><th>Last</th></tr>");
    while ($row = db2_fetch_array($stmt)) {
        print "\t<tr><td>$row[1]</td><td>$row[2]</td><td>$row[3]</td></tr>\n";
    }
    print "</table>\n";
    db2_close($conn);
}
else {
    echo "Connection failed.";
}
?>

</body>
</html>
```

3. Point your web browser to this new file:

```
http://localhost/testdb2.php
```

If the connection succeeds, a list of employees from the EMP table of the SAMPLE database is displayed.



Best practices

- DB2 Express-C supports only the LTS versions of the Ubuntu operating system
- Use the Advanced Packaging Tool (APT) to install and configure PHP 5, Apache HTTP Server, and DB2 Express-C.
- Add the Canonical Partner Repository to the `/etc/apt/sources.list` configuration file.
- Use the `apt-get update` command to refresh the packages in your repository list.
- Activate your database to eliminate any application time spent on database initialization.
- Use the PEAR PECL utility to download and install the `ibm_db2` PECL extension.

Conclusion

Combining the power of IBM DB2 Express-C with the Apache HTTP server and the PHP programming language on a system running the Ubuntu Linux operating system, provides a powerful, flexible, and reliable application development platform. This platform is ideal for small businesses, developers, instructors, and students, because the software components are free to download and use.

By following the tasks described in this paper, you have successfully set up IBM DB2 Express-C with PHP and the Apache HTTP Server on the Ubuntu operating system. You are now ready to develop and deploy dynamic data-driven content for your website.

Further reading

For additional information about getting up and running quickly, see the following related resources. These resources include supplementary information about installing and configuring DB2 Express-C, Ubuntu, PHP, and Apache.

- DB2 Best Practices: <http://www.ibm.com/developerworks/data/bestpractices/>
- DB2 Express-C: <http://www-01.ibm.com/software/data/db2/express/>
- DB2 V9.7 Information Center:
<http://publib.boulder.ibm.com/infocenter/db2luw/v9r7/index.jsp>
- Ubuntu: <http://www.ubuntu.com/>
- Ubuntu 10.04: <https://help.ubuntu.com/10.04/index.html>
- PHP Hypertext Preprocessor: <http://www.php.net/>
- Apache HTTP Server: http://projects.apache.org/projects/http_server.html
- ibm_db2 PECL extension: http://pecl.php.net/package/ibm_db2

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