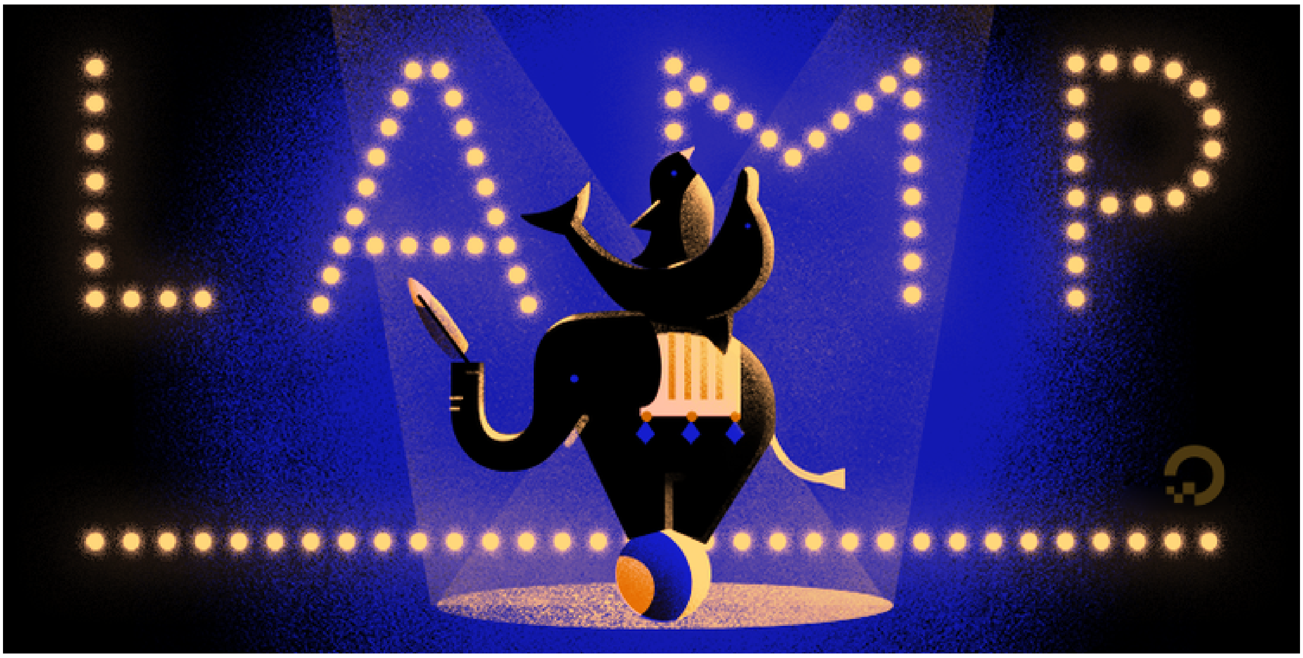


Tutorial

How To Install Linux, Apache, MySQL, PHP (LAMP) stack on Ubuntu 20.04

Introduction

A “LAMP” stack is a group of open-source software that is typically installed together in order to enable a server to host dynamic websites and web apps written in PHP. This term is an acronym which represents the **L**inux operating system, with the **A**pache web server. The site data is stored in a **M**ySQL database, and dynamic content is processed by **P**HP.

In this guide, we’ll install a LAMP stack on an Ubuntu 20.04 server.

Prerequisites

In order to complete this tutorial, you will need to have an Ubuntu 20.04 server with a non-root sudo-enabled user account and a basic firewall. This can be configured using our initial server setup guide for Ubuntu 20.04.

Step 1 — Installing Apache and Updating the Firewall

The Apache web server is among the most popular web servers in the world. It’s well documented, has an active community of users, and has been in wide use for much of the history of the web, which makes it a great default choice for hosting a website.

Install Apache using Ubuntu’s package manager, apt:

- `sudo apt update`

- `sudo apt install apache2`

If this is the first time you’re using sudo within this session, you’ll be prompted to provide your user’s password to confirm you have the right privileges to manage system packages with apt. You’ll also be prompted to confirm Apache’s installation by pressing Y, then ENTER.

Once the installation is finished, you’ll need to adjust your firewall settings to allow HTTP traffic. UFW has different application profiles that you can leverage for accomplishing that. To list all currently available UFW application profiles, you can run:

- `sudo ufw app list`

You’ll see output like this:

```
Output
Available applications:
  Apache
  Apache Full
  Apache Secure
  OpenSSH
```

Here’s what each of these profiles mean:

- **Apache**: This profile opens only port 80 (normal, unencrypted web traffic).
- **Apache Full**: This profile opens both port 80 (normal, unencrypted web traffic) and port 443 (TLS/SSL encrypted traffic).
- **Apache Secure**: This profile opens only port 443 (TLS/SSL encrypted traffic).

For now, it’s best to allow only connections on port 80, since this is a fresh Apache installation and you still don’t have a TLS/SSL certificate configured to allow for HTTPS traffic on your server.

To only allow traffic on port 80, use the Apache profile:

- `sudo ufw allow in "Apache"`

You can verify the change with:

- `sudo ufw status`

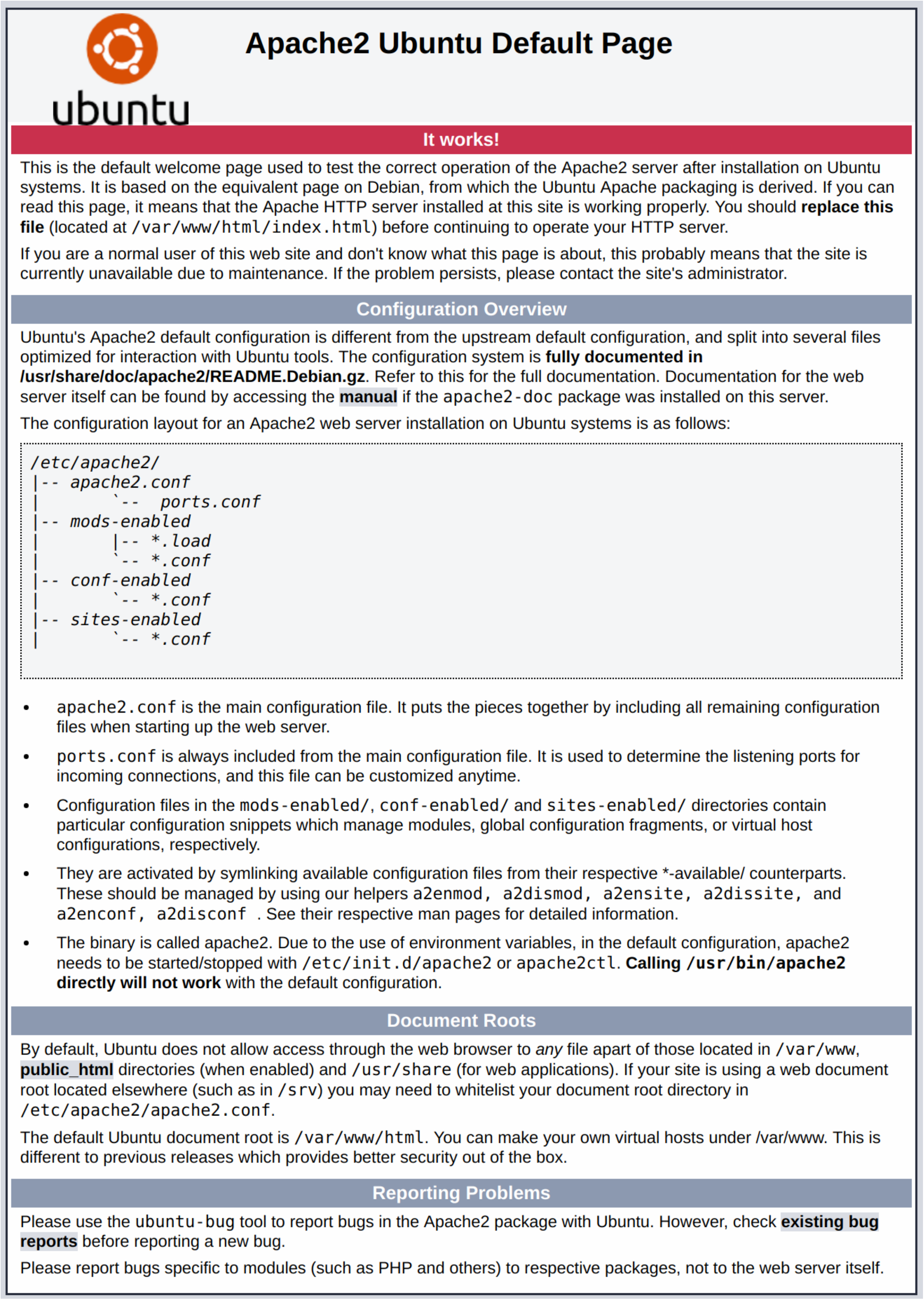
```
Output
Status: active

To                         Action      From
--                         ------      ----
OpenSSH                    ALLOW       Anywhere
Apache                     ALLOW       Anywhere
OpenSSH (v6)               ALLOW       Anywhere (v6)
Apache (v6)                ALLOW       Anywhere (v6)
```

Traffic on port 80 is now allowed through the firewall.

You can do a spot check right away to verify that everything went as planned by visiting your server's public IP address in your web browser (see the note under the next heading to find out what your public IP address is if you do not have this information already):

```
http://your_server_ip
```

You'll see the default Ubuntu 20.04 Apache web page, which is there for informational and testing purposes. It should look something like this:



Apache2 Ubuntu Default Page

It works!

This is the default welcome page used to test the correct operation of the Apache2 server after installation on Ubuntu systems. It is based on the equivalent page on Debian, from which the Ubuntu Apache packaging is derived. If you can read this page, it means that the Apache HTTP server installed at this site is working properly. You should **replace this file** (located at `/var/www/html/index.html`) before continuing to operate your HTTP server.

If you are a normal user of this web site and don't know what this page is about, this probably means that the site is currently unavailable due to maintenance. If the problem persists, please contact the site's administrator.

Configuration Overview

Ubuntu's Apache2 default configuration is different from the upstream default configuration, and split into several files optimized for interaction with Ubuntu tools. The configuration system is **fully documented in /usr/share/doc/apache2/README.Debian.gz**. Refer to this for the full documentation. Documentation for the web server itself can be found by accessing the **manual** if the `apache2-doc` package was installed on this server.

The configuration layout for an Apache2 web server installation on Ubuntu systems is as follows:

```
/etc/apache2/
|-- apache2.conf
|       `--  ports.conf
|-- mods-enabled
|       |-- *.load
|       `-- *.conf
|-- conf-enabled
|       `-- *.conf
|-- sites-enabled
|       `-- *.conf
```

- `apache2.conf` is the main configuration file. It puts the pieces together by including all remaining configuration files when starting up the web server.
- `ports.conf` is always included from the main configuration file. It is used to determine the listening ports for incoming connections, and this file can be customized anytime.
- Configuration files in the `mods-enabled/`, `conf-enabled/` and `sites-enabled/` directories contain particular configuration snippets which manage modules, global configuration fragments, or virtual host configurations, respectively.
- They are activated by symlinking available configuration files from their respective *-available/ counterparts. These should be managed by using our helpers `a2enmod`, `a2dismod`, `a2ensite`, `a2dissite`, and `a2enconf`, `a2disconf` . See their respective man pages for detailed information.
- The binary is called apache2. Due to the use of environment variables, in the default configuration, apache2 needs to be started/stopped with `/etc/init.d/apache2` or `apache2ctl`. **Calling `/usr/bin/apache2` directly will not work** with the default configuration.

Document Roots

By default, Ubuntu does not allow access through the web browser to *any* file apart of those located in `/var/www`, **public_html** directories (when enabled) and `/usr/share` (for web applications). If your site is using a web document root located elsewhere (such as in `/srv`) you may need to whitelist your document root directory in `/etc/apache2/apache2.conf`.

The default Ubuntu document root is `/var/www/html`. You can make your own virtual hosts under /var/www. This is different to previous releases which provides better security out of the box.

Reporting Problems

Please use the `ubuntu-bug` tool to report bugs in the Apache2 package with Ubuntu. However, check **existing bug reports** before reporting a new bug.

Please report bugs specific to modules (such as PHP and others) to respective packages, not to the web server itself.

If you see this page, then your web server is now correctly installed and accessible through your firewall.

How To Find your Server's Public IP Address

If you do not know what your server's public IP address is, there are a number of ways you can find it. Usually, this is the address you use to connect to your server through SSH.

There are a few different ways to do this from the command line. First, you could use the iproute2 tools to get your IP address by typing this:

```
ip addr show eth0 | grep inet | awk '{ print $2; }' | sed 's/\/.*$//'
```

This will give you two or three lines back. They are all correct addresses, but your computer may only be able to use one of them, so feel free to try each one.

An alternative method is to use the curl utility to contact an outside party to tell you how *it* sees your server. This is done by asking a specific server what your IP address is:

```
curl http://icanhazip.com
```

Regardless of the method you use to get your IP address, type it into your web browser's address bar to view the default Apache page.

Step 2 — Installing MySQL

Now that you have a web server up and running, you need to install the database system to be able to store and manage data for your site. MySQL is a popular database management system used within PHP environments.

Again, use apt to acquire and install this software:

```
sudo apt install mysql-server
```

When prompted, confirm installation by typing Y, and then ENTER.

When the installation is finished, it's recommended that you run a security script that comes pre-installed with MySQL. This script will remove some insecure default settings and lock down access to your database system. Start the interactive script by running:

-
  ```
  sudo mysql_secure_installation
  ```

This will ask if you want to configure the VALIDATE PASSWORD PLUGIN.

Note: Enabling this feature is something of a judgment call. If enabled, passwords which don't match the specified criteria will be rejected by MySQL with an error. It is safe to leave validation disabled, but you should always use strong, unique passwords for database credentials.

Answer Y for yes, or anything else to continue without enabling.

```
VALIDATE PASSWORD PLUGIN can be used to test passwords
and improve security. It checks the strength of password
and allows the users to set only those passwords which are
secure enough. Would you like to setup VALIDATE PASSWORD plugin?

Press y|Y for Yes, any other key for No:
```

If you answer "yes", you'll be asked to select a level of password validation. Keep in mind that if you enter 2 for the strongest level, you will receive errors when attempting to set any password which does not contain numbers, upper and lowercase letters, and special characters, or which is based on common dictionary words.

```
There are three levels of password validation policy:

LOW    Length >= 8
MEDIUM Length >= 8, numeric, mixed case, and special characters
STRONG Length >= 8, numeric, mixed case, special characters and dictionary              file

Please enter 0 = LOW, 1 = MEDIUM and 2 = STRONG: 1
```

Regardless of whether you chose to set up the VALIDATE PASSWORD PLUGIN, your server will next ask you to select and confirm a password for the MySQL **root** user. This is not to be confused with the **system root**. The **database root** user is an administrative user with full privileges over the database system. Even though the default authentication method for the MySQL root user dispenses the use of a password, **even when one is set**, you should define a strong password here as an additional safety measure. We'll talk about this in a moment.

If you enabled password validation, you'll be shown the password strength for the root password you just entered and your server will ask if you want to continue with that password. If you are happy with your current password, enter Y for "yes" at the prompt:

```
Estimated strength of the password: 100
Do you wish to continue with the password provided?(Press y|Y for Yes, any other key for No) : y
```

For the rest of the questions, press Y and hit the ENTER key at each prompt. This will remove some anonymous users and the test database, disable remote root logins, and load these new rules so that MySQL immediately respects the changes you have made.

When you're finished, test if you're able to log in to the MySQL console by typing:

- `sudo mysql`

This will connect to the MySQL server as the administrative database user **root**, which is inferred by the use of sudo when running this command. You should see output like this:

```
Output
Welcome to the MySQL monitor.  Commands end with ; or \g.
Your MySQL connection id is 22
Server version: 8.0.19-0ubuntu5 (Ubuntu)

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affiliates. Other names may be trademarks of their respective
owners.

Type 'help;' or '\h' for help. Type '\c' to clear the current input statement.

mysql>
```

To exit the MySQL console, type:

- `exit`

Notice that you didn't need to provide a password to connect as the **root** user, even though you have defined one when running the mysql_secure_installation script. That is because the default authentication method for the administrative MySQL user is unix_socket instead of password. Even though this might look like a security concern at first, it makes the database server more secure because the only users allowed to log in as the **root** MySQL user are the system users with sudo privileges connecting from the console or through an application running with the same privileges. In practical terms, that means you won't be able to use the administrative database **root** user to connect from your PHP application. Setting a password for the **root** MySQL account works as a safeguard, in case the default authentication method is changed from unix_socket to password.

For increased security, it's best to have dedicated user accounts with less expansive privileges set up for every database, especially if you plan on having multiple databases hosted on your server.

Note: At the time of this writing, the native MySQL PHP library mysqlnd doesn't support caching_sha2_authentication, the default authentication method for MySQL 8. For that reason, when creating database users for PHP applications on MySQL 8, you'll need to make sure they're configured to use mysql_native_password instead. We'll demonstrate how to do that in Step 6.

Your MySQL server is now installed and secured. Next, we'll install PHP, the final component in the LAMP stack.

Step 3 — Installing PHP

You have Apache installed to serve your content and MySQL installed to store and manage your data. PHP is the component of our setup that will process code to display dynamic content to the final user. In addition to the php package, you'll need php-mysql, a PHP module that allows PHP to communicate with MySQL-based databases. You'll also need libapache2-mod-php to enable Apache to handle PHP files. Core PHP packages will automatically be installed as dependencies.

To install these packages, run:

```
sudo apt install php libapache2-mod-php php-mysql
```

Once the installation is finished, you can run the following command to confirm your PHP version:

```
php -v
```

```
Output
PHP 7.4.3 (cli) (built: Mar 26 2020 20:24:23) ( NTS )
Copyright (c) The PHP Group
Zend Engine v3.4.0, Copyright (c) Zend Technologies
    with Zend OPcache v7.4.3, Copyright (c), by Zend Technologies
```

At this point, your LAMP stack is fully operational, but before you can test your setup with a PHP script, it's best to set up a proper Apache Virtual Host to hold your website's files and folders. We'll do that in the next step.

Step 4 — Creating a Virtual Host for your Website

When using the Apache web server, you can create *virtual hosts* (similar to server blocks in Nginx) to encapsulate configuration details and host more than one domain from a single server. In this guide, we'll set up a domain called **your_domain**, but you should **replace this with your own domain name**.

Note: In case you are using DigitalOcean as DNS hosting provider, you can check our product docs for detailed instructions on how to set up a new domain name and point it to your server.

Apache on Ubuntu 20.04 has one server block enabled by default that is configured to serve documents from the /var/www/html directory. While this works well for a single site, it can become unwieldy if you are hosting multiple sites. Instead of modifying /var/www/html, we'll create a directory structure within /var/www for the **your_domain** site, leaving /var/www/html in place as the default directory to be served if a client request doesn't match any other sites.

Create the directory for **your_domain** as follows:

```
sudo mkdir /var/www/your_domain
```

Next, assign ownership of the directory with the $USER environment variable, which will reference your current system user:

```
sudo chown -R $USER:$USER /var/www/your_domain
```

Then, open a new configuration file in Apache's sites-available directory using your preferred command-line editor. Here, we’ll use nano:

-
  ```
  sudo nano /etc/apache2/sites-available/your_domain.conf
  ```

This will create a new blank file. Paste in the following bare-bones configuration:

/etc/apache2/sites-available/your_domain.conf

```
<VirtualHost *:80>
    ServerName your_domain
    ServerAlias www.your_domain
    ServerAdmin webmaster@localhost
    DocumentRoot /var/www/your_domain
    ErrorLog ${APACHE_LOG_DIR}/error.log
    CustomLog ${APACHE_LOG_DIR}/access.log combined
</VirtualHost>
```

Save and close the file when you’re done. If you’re using nano, you can do that by pressing CTRL+X, then Y and ENTER.

With this VirtualHost configuration, we’re telling Apache to serve your_domain using /var/www/your_domain as the web root directory. If you’d like to test Apache without a domain name, you can remove or comment out the options ServerName and ServerAlias by adding a # character in the beginning of each option’s lines.

You can now use a2ensite to enable the new virtual host:

-
  ```
  sudo a2ensite your_domain
  ```

You might want to disable the default website that comes installed with Apache. This is required if you’re not using a custom domain name, because in this case Apache’s default configuration would overwrite your virtual host. To disable Apache’s default website, type:

-
  ```
  sudo a2dissite 000-default
  ```

To make sure your configuration file doesn’t contain syntax errors, run:

-
  ```
  sudo apache2ctl configtest
  ```

Finally, reload Apache so these changes take effect:

- `sudo systemctl reload apache2`

Your new website is now active, but the web root /var/www/your_domain is still empty. Create an index.html file in that location so that we can test that the virtual host works as expected:

- `nano /var/www/your_domain/index.html`

Include the following content in this file:

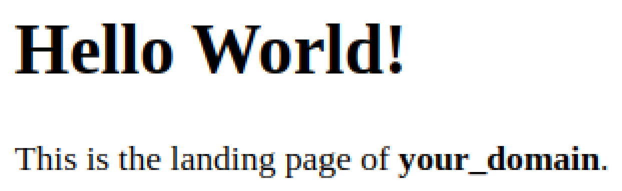
/var/www/your_domain/index.html

```
<html>
  <head>
    <title>your_domain website</title>
  </head>
  <body>
    <h1>Hello World!</h1>

    <p>This is the landing page of <strong>your_domain</strong>.</p>
  </body>
</html>
```

Now go to your browser and access your server's domain name or IP address once again:

```
http://server_domain_or_IP
```

You'll see a page like this:



Hello World!

This is the landing page of **your_domain**.

If you see this page, it means your Apache virtual host is working as expected.

You can leave this file in place as a temporary landing page for your application until you set up an index.php file to replace it. Once you do that, remember to remove or rename the index.html file from your document root, as it would take precedence over an index.php file by default.

A Note About DirectoryIndex on Apache

With the default DirectoryIndex settings on Apache, a file named index.html will always take precedence over an index.php file. This is useful for setting up maintenance pages in PHP applications, by creating a temporary index.html file containing an informative message to visitors. Because this page will take precedence over the index.php page, it will then become the landing page for the application. Once maintenance is over, the index.html is renamed or removed from the document root, bringing back the regular application page.

In case you want to change this behavior, you'll need to edit the /etc/apache2/mods-enabled/dir.conf file and modify the order in which the index.php file is listed within the DirectoryIndex directive:

```
sudo nano /etc/apache2/mods-enabled/dir.conf
```

/etc/apache2/mods-enabled/dir.conf

```
<IfModule mod_dir.c>
        DirectoryIndex index.php index.html index.cgi index.pl index.xhtml index.htm
</IfModule>
```

After saving and closing the file, you'll need to reload Apache so the changes take effect:

```
sudo systemctl reload apache2
```

In the next step, we'll create a PHP script to test that PHP is correctly installed and configured on your server.

Step 5 — Testing PHP Processing on your Web Server

Now that you have a custom location to host your website's files and folders, we'll create a PHP test script to confirm that Apache is able to handle and process requests for PHP files.

Create a new file named info.php inside your custom web root folder:

```
nano /var/www/your_domain/info.php
```

This will open a blank file. Add the following text, which is valid PHP code, inside the file:

/var/www/your_domain/info.php

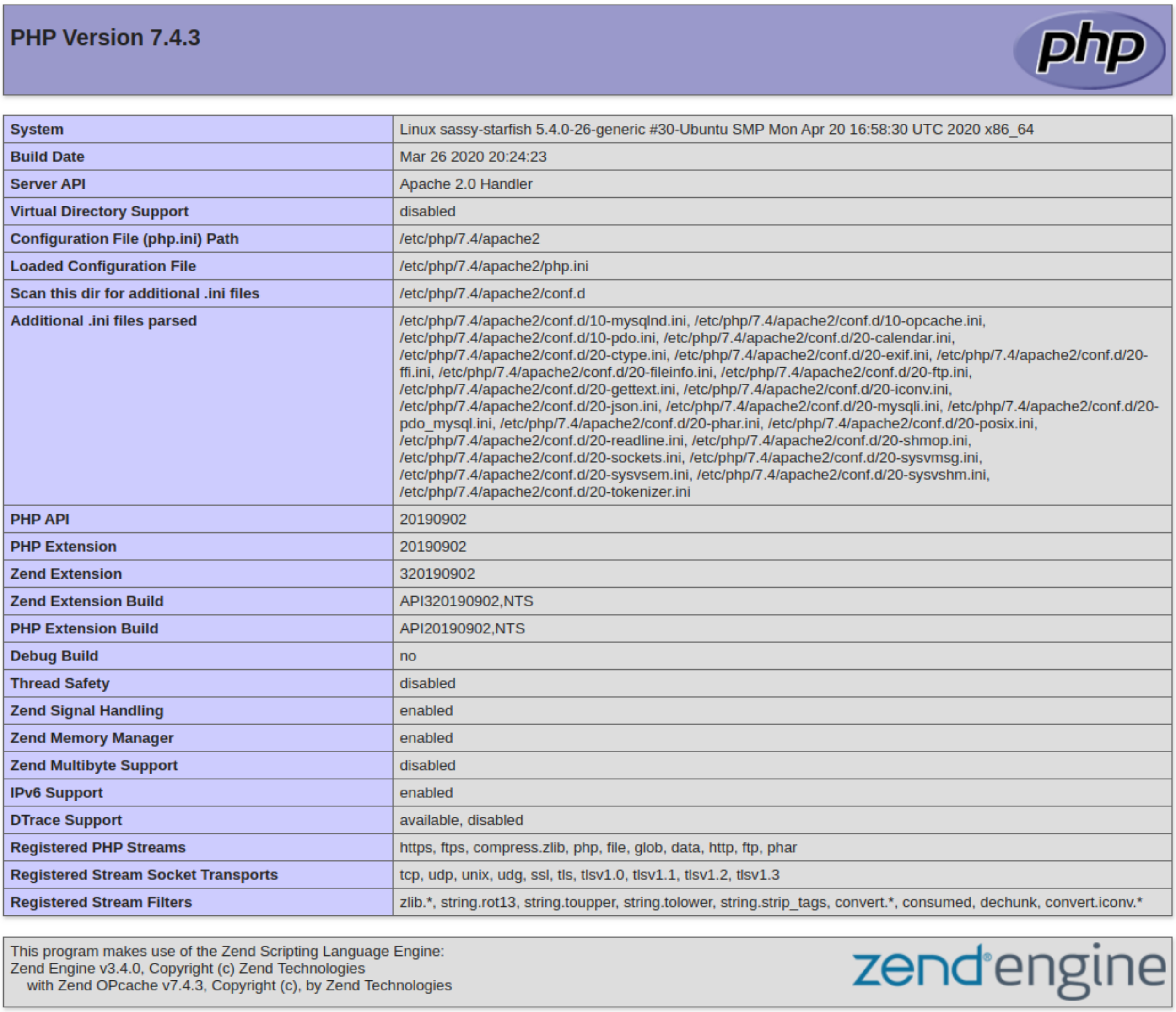
```
<?php
phpinfo();
```

When you are finished, save and close the file.

To test this script, go to your web browser and access your server's domain name or IP address, followed by the script name, which in this case is info.php:

```
http://server_domain_or_IP/info.php
```

You'll see a page similar to this:



PHP Version 7.4.3

System	Linux sassy-starfish 5.4.0-26-generic #30-Ubuntu SMP Mon Apr 20 16:58:30 UTC 2020 x86_64
Build Date	Mar 26 2020 20:24:23
Server API	Apache 2.0 Handler
Virtual Directory Support	disabled
Configuration File (php.ini) Path	/etc/php/7.4/apache2
Loaded Configuration File	/etc/php/7.4/apache2/php.ini
Scan this dir for additional .ini files	/etc/php/7.4/apache2/conf.d
Additional .ini files parsed	/etc/php/7.4/apache2/conf.d/10-mysqlnd.ini, /etc/php/7.4/apache2/conf.d/10-opcache.ini, /etc/php/7.4/apache2/conf.d/10-pdo.ini, /etc/php/7.4/apache2/conf.d/20-calendar.ini, /etc/php/7.4/apache2/conf.d/20-ctype.ini, /etc/php/7.4/apache2/conf.d/20-exif.ini, /etc/php/7.4/apache2/conf.d/20-ffi.ini, /etc/php/7.4/apache2/conf.d/20-fileinfo.ini, /etc/php/7.4/apache2/conf.d/20-ftp.ini, /etc/php/7.4/apache2/conf.d/20-gettext.ini, /etc/php/7.4/apache2/conf.d/20-iconv.ini, /etc/php/7.4/apache2/conf.d/20-json.ini, /etc/php/7.4/apache2/conf.d/20-mysqli.ini, /etc/php/7.4/apache2/conf.d/20-pdo_mysql.ini, /etc/php/7.4/apache2/conf.d/20-phar.ini, /etc/php/7.4/apache2/conf.d/20-posix.ini, /etc/php/7.4/apache2/conf.d/20-readline.ini, /etc/php/7.4/apache2/conf.d/20-shmop.ini, /etc/php/7.4/apache2/conf.d/20-sockets.ini, /etc/php/7.4/apache2/conf.d/20-sysvmsg.ini, /etc/php/7.4/apache2/conf.d/20-sysvsem.ini, /etc/php/7.4/apache2/conf.d/20-sysvshm.ini, /etc/php/7.4/apache2/conf.d/20-tokenizer.ini
PHP API	20190902
PHP Extension	20190902
Zend Extension	320190902
Zend Extension Build	API320190902,NTS
PHP Extension Build	API20190902,NTS
Debug Build	no
Thread Safety	disabled
Zend Signal Handling	enabled
Zend Memory Manager	enabled
Zend Multibyte Support	disabled
IPv6 Support	enabled
DTrace Support	available, disabled
Registered PHP Streams	https, ftps, compress.zlib, php, file, glob, data, http, ftp, phar
Registered Stream Socket Transports	tcp, udp, unix, udg, ssl, tls, tlsv1.0, tlsv1.1, tlsv1.2, tlsv1.3
Registered Stream Filters	zlib.*, string.rot13, string.toupper, string.tolower, string.strip_tags, convert.*, consumed, dechunk, convert.iconv.*

This program makes use of the Zend Scripting Language Engine:
Zend Engine v3.4.0, Copyright (c) Zend Technologies
with Zend OPcache v7.4.3, Copyright (c), by Zend Technologies

This page provides information about your server from the perspective of PHP. It is useful for debugging and to ensure that your settings are being applied correctly.

If you can see this page in your browser, then your PHP installation is working as expected.

After checking the relevant information about your PHP server through that page, it’s best to remove the file you created as it contains sensitive information about your PHP environment -and your Ubuntu server. You can use rm to do so:

-
  ```
  sudo rm /var/www/your_domain/info.php
  ```

You can always recreate this page if you need to access the information again later.

Step 6 — Testing Database Connection from PHP (Optional)

If you want to test whether PHP is able to connect to MySQL and execute database queries, you can create a test table with dummy data and query for its contents from a PHP script. Before we can do that, we need to create a test database and a new MySQL user properly configured to access it.

At the time of this writing, the native MySQL PHP library mysqlnd doesn’t support caching_sha2_authentication, the default authentication method for MySQL 8. We’ll need to create a new user with the mysql_native_password authentication method in order to be able to connect to the MySQL database from PHP.

We’ll create a database named **example_database** and a user named **example_user**, but you can replace these names with different values.

First, connect to the MySQL console using the **root** account:

-
  ```
  sudo mysql
  ```

To create a new database, run the following command from your MySQL console:

- `CREATE DATABASE example_database;`

Now you can create a new user and grant them full privileges on the custom database you've just created.

The following command creates a new user named example_user, using mysql_native_password as default authentication method. We're defining this user's password as password, but you should replace this value with a secure password of your own choosing.

- `CREATE USER 'example_user'@'%' IDENTIFIED WITH mysql_native_password BY 'password';`

Now we need to give this user permission over the example_database database:

- `GRANT ALL ON example_database.* TO 'example_user'@'%';`

This will give the **example_user** user full privileges over the **example_database** database, while preventing this user from creating or modifying other databases on your server.
Now exit the MySQL shell with:

- `exit`

You can test if the new user has the proper permissions by logging in to the MySQL console again, this time using the custom user credentials:

- `mysql -u example_user -p`

Notice the -p flag in this command, which will prompt you for the password used when creating the **example_user** user. After logging in to the MySQL console, confirm that you have access to the **example_database** database:

- `SHOW DATABASES;`

This will give you the following output:

```
Output
+--------------------+
| Database           |
+--------------------+
| example_database   |
| information_schema |
+--------------------+
2 rows in set (0.000 sec)
```

Next, we’ll create a test table named **todo_list.** From the MySQL console, run the following statement:

```
CREATE TABLE example_database.todo_list (
    item_id INT AUTO_INCREMENT,
    content VARCHAR(255),
    PRIMARY KEY(item_id)
);
```

Insert a few rows of content in the test table. You might want to repeat the next command a few times, using different values:

```
INSERT INTO example_database.todo_list (content) VALUES ("My first important item");
```

To confirm that the data was successfully saved to your table, run:

```
SELECT * FROM example_database.todo_list;
```

You’ll see the following output:

```
Output
+---------+--------------------------+
| item_id | content                  |
+---------+--------------------------+
|       1 | My first important item  |
|       2 | My second important item |
|       3 | My third important item  |
|       4 | and this one more thing  |
+---------+--------------------------+
4 rows in set (0.000 sec)
```

After confirming that you have valid data in your test table, you can exit the MySQL console:

```
exit
```

Now you can create the PHP script that will connect to MySQL and query for your content. Create a new PHP file in your custom web root directory using your preferred editor. We’ll use nano for that:

- `nano /var/www/your_domain/todo_list.php`

The following PHP script connects to the MySQL database and queries for the content of the **todo_list** table, exhibiting the results in a list. If there’s a problem with the database connection, it will throw an exception.
Copy this content into your todo_list.php script:

/var/www/your_domain/todo_list.php

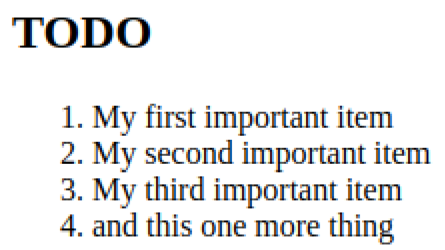
```
<?php
$user = "example_user";
$password = "password";
$database = "example_database";
$table = "todo_list";

try {
  $db = new PDO("mysql:host=localhost;dbname=$database", $user, $password);
  echo "<h2>TODO</h2><ol>";
  foreach($db->query("SELECT content FROM $table") as $row) {
    echo "<li>" . $row['content'] . "</li>";
  }
  echo "</ol>";
} catch (PDOException $e) {
    print "Error!: " . $e->getMessage() . "<br/>";
    die();
}
```

Save and close the file when you’re done editing.

You can now access this page in your web browser by visiting the domain name or public IP address configured for your website, followed by /todo_list.php:

```
http://your_domain_or_IP/todo_list.php
```

You should see a page like this, showing the content you’ve inserted in your test table:



TODO

1. My first important item
2. My second important item
3. My third important item
4. and this one more thing

That means your PHP environment is ready to connect and interact with your MySQL server.

Conclusion

In this guide, we’ve built a flexible foundation for serving PHP websites and applications to your visitors, using Apache as web server and MySQL as database system.

As an immediate next step, you should ensure that connections to your web server are secured, by serving them via HTTPS. In order to accomplish that, you can use Let’s Encrypt to secure your site with a free TLS/SSL certificate.