# **Python CGI Programming**

\*\*\*Please execute all codes given in Apache folder on allocated VM.

The Common Gateway Interface, or CGI, is a set of standards that define how information is exchanged between the web server and a custom script. The CGI specs are currently maintained by the NCSA.

## **What is CGI?**

* The Common Gateway Interface, or CGI, is a standard for external gateway programs to interface with information servers such as HTTP servers.
* The current version is CGI/1.1 and CGI/1.2 is under progress.

## **Web Browsing**

To understand the concept of CGI, let us see what happens when we click a hyper link to browse a particular web page or URL.

* Your browser contacts the HTTP web server and demands for the URL, i.e., filename.
* Web Server parses the URL and looks for the filename. If it finds that file then sends it back to the browser, otherwise sends an error message indicating that you requested a wrong file.
* Web browser takes response from web server and displays either the received file or error message.

However, it is possible to set up the HTTP server so that whenever a file in a certain directory is requested that file is not sent back; instead it is executed as a program, and whatever that program outputs is sent back for your browser to display. This function is called the Common Gateway Interface or CGI and the programs are called CGI scripts. These CGI programs can be a Python Script, PERL Script, Shell Script, C or C++ program, etc.

## **CGI Architecture Diagram**



## **Web Server Support and Configuration**

Before you proceed with CGI Programming, make sure that your Web Server supports CGI and it is configured to handle CGI Programs. All the CGI Programs to be executed by the HTTP server are kept in a pre-configured directory. This directory is called CGI Directory and by convention it is named as /var/www/cgi-bin. By convention, CGI files have extension as.**cgi,** but you can keep your files with python extension **.py** as well.

By default, the Linux server is configured to run only the scripts in the cgi-bin directory in /var/www.

Here, we assume that you have Web Server up and running successfully and you are able to run any other CGI program like Perl or Shell, etc.

## **First CGI Program**

Here is a simple link, which is linked to a CGI script called [hello.py](https://www.tutorialspoint.com/cgi-bin/hello.py). This file is kept in /var/www/cgi-bin directory and it has following content. Before running your CGI program, make sure you have change mode of file using**chmod 755 hello.py** UNIX command to make file executable.

#!/usr/bin/python

print "Content-type:text/html\r\n\r\n"

print '<html>'

print '<head>'

print '<title>Hello Word - First CGI Program</title>'

print '</head>'

print '<body>'

print '<h2>Hello Word! This is my first CGI program</h2>'

print '</body>'

print '</html>'

If you click hello.py, or access it as <http://localhost/cgi-bin/Hello.py> in the browser, then this produces the following output −

|  |
| --- |
| **Hello Word! This is my first CGI program** |

**You can write a html file to access this CGI scipt-**

**<!-- put it in /htdocs dir-->**

**<html>**

**<body>**

**<form method="get" action="/cgi-bin/Hello.py">**

**<input type = "submit" name="b1" value ="Click Me">**

**</form>**

**</body>**

**</html>**

This hello.py script is a simple Python script, which writes its output on STDOUT file, i.e., screen. There is one important and extra feature available which is first line to be printed **Content-type:text/html\r\n\r\n**. This line is sent back to the browser and it specifies the content type to be displayed on the browser screen.

By now you must have understood basic concept of CGI and you can write many complicated CGI programs using Python. This script can interact with any other external system also to exchange information such as RDBMS.

## **HTTP Header**

The line **Content-type:text/html\r\n\r\n** is part of HTTP header which is sent to the browser to understand the content. All the HTTP header will be in the following form −

HTTP Field Name: Field Content

For Example

Content-type: text/html\r\n\r\n

## **GET and POST Methods**

You must have come across many situations when you need to pass some information from your browser to web server and ultimately to your CGI Program. Most frequently, browser uses two methods two pass this information to web server. These methods are GET Method and POST Method.

## **Passing Information using GET method**

The GET method sends the encoded user information appended to the page request. The page and the encoded information are separated by the ? character as follows −

http://www.test.com/cgi-bin/hello.py?key1=value1&key2=value2

The GET method is the default method to pass information from browser to web server and it produces a long string that appears in your browser's Location:box. Never use GET method if you have password or other sensitive information to pass to the server. The GET method has size limtation: only 1024 characters can be sent in a request string. The GET method sends information using QUERY\_STRING header and will be accessible in your CGI Program through QUERY\_STRING environment variable.

You can pass information by simply concatenating key and value pairs along with any URL or you can use HTML <FORM> tags to pass information using GET method.

## **Simple URL Example:Get Method**

Here is a simple URL, which passes two values to hello\_get.py program using GET method.

[/cgi-bin/hello\_get.py?first\_name=ZARA&last\_name=ALI](https://www.tutorialspoint.com/cgi-bin/hello_get.py?first_name=ZARA&last_name=ALI)

Below is **hello\_get.py** script to handle input given by web browser. We are going to use **cgi** module, which makes it very easy to access passed information –

**hello\_get.py**

#!/usr/bin/python

# Import modules for CGI handling

import cgi, cgitb

# Create instance of FieldStorage

form = cgi.FieldStorage()

# Get data from fields

first\_name = form.getvalue('first\_name')

last\_name = form.getvalue('last\_name')

print "Content-type:text/html\r\n\r\n"

print "<html>"

print "<head>"

print "<title>Hello - Second CGI Program</title>"

print "</head>"

print "<body>"

print "<h2>Hello %s %s</h2>" % (first\_name, last\_name)

print "</body>"

print "</html>

## **Simple FORM Example:GET Method**

This example passes two values using HTML FORM and submit button. We use same CGI script hello\_get.py to handle this input.

<form action="/cgi-bin/hello\_get.py" method="get">

First Name: <input type="text" name="first\_name"> <br />

Last Name: <input type="text" name="last\_name" />

<input type="submit" value="Submit" />

</form>

Here is the actual output of the above form, you enter First and Last Name and then click submit button to see the result.

Top of Form

First Name:



Last Name:



Bottom of Form

## **Passing Information Using POST Method**

A generally more reliable method of passing information to a CGI program is the POST method. This packages the information in exactly the same way as GET methods, but instead of sending it as a text string after a ? in the URL it sends it as a separate message. This message comes into the CGI script in the form of the standard input.

Let us take again same example as above which passes two values using HTML FORM and submit button. We use same CGI script hello\_get.py to handle this input.

<form action="/cgi-bin/hello\_get.py" method="post">

First Name: <input type="text" name="first\_name"><br />

Last Name: <input type="text" name="last\_name" />

<input type="submit" value="Submit" />

</form>

## **Passing Checkbox Data to CGI Program**

Checkboxes are used when more than one option is required to be selected.

Here is example HTML code for a form with two checkboxes −

<form action="/cgi-bin/checkbox.cgi" method="POST" target="\_blank">

<input type="checkbox" name="maths" value="on" /> Maths

<input type="checkbox" name="physics" value="on" /> Physics

<input type="submit" value="Select Subject" />

</form>

The result of this code is the following form:

Top of Form

 Maths  Physics



Bottom of Form

Below is checkbox.cgi script to handle input given by web browser for checkbox button.

#!/usr/bin/python

# Import modules for CGI handling

import cgi, cgitb

# Create instance of FieldStorage

form = cgi.FieldStorage()

# Get data from fields

if form.getvalue('maths'):

math\_flag = "ON"

else:

math\_flag = "OFF"

if form.getvalue('physics'):

physics\_flag = "ON"

else:

physics\_flag = "OFF"

print "Content-type:text/html\r\n\r\n"

print "<html>"

print "<head>"

print "<title>Checkbox - Third CGI Program</title>"

print "</head>"

print "<body>"

print "<h2> CheckBox Maths is : %s</h2>" % math\_flag

print "<h2> CheckBox Physics is : %s</h2>" % physics\_flag

print "</body>"

print "</html>"

## **Passing Radio Button Data to CGI Program**

Radio Buttons are used when only one option is required to be selected.

Here is example HTML code for a form with two radio buttons −

<form action="/cgi-bin/radiobutton.py" method="post" target="\_blank">

<input type="radio" name="subject" value="maths" /> Maths

<input type="radio" name="subject" value="physics" /> Physics

<input type="submit" value="Select Subject" />

</form>

The result of this code is the following form −

Top of Form

 Maths  Physics



Bottom of Form

Below is radiobutton.py script to handle input given by web browser for radio button:

#!/usr/bin/python

# Import modules for CGI handling

import cgi, cgitb

# Create instance of FieldStorage

form = cgi.FieldStorage()

# Get data from fields

if form.getvalue('subject'):

subject = form.getvalue('subject')

else:

subject = "Not set"

print "Content-type:text/html\r\n\r\n"

print "<html>"

print "<head>"

print "<title>Radio - Fourth CGI Program</title>"

print "</head>"

print "<body>"

print "<h2> Selected Subject is %s</h2>" % subject

print "</body>"

print "</html>"

## **Passing Text Area Data to CGI Program**

TEXTAREA element is used when multiline text has to be passed to the CGI Program.

Here is example HTML code for a form with a TEXTAREA box −

<form action="/cgi-bin/textarea.py" method="post" target="\_blank">

<textarea name="textcontent" cols="40" rows="4">

Type your text here...

</textarea>

<input type="submit" value="Submit" />

</form>

The result of this code is the following form −

Top of Form



Bottom of Form

Below is textarea.cgi script to handle input given by web browser −

#!/usr/bin/python

# Import modules for CGI handling

import cgi, cgitb

# Create instance of FieldStorage

form = cgi.FieldStorage()

# Get data from fields

if form.getvalue('textcontent'):

text\_content = form.getvalue('textcontent')

else:

text\_content = "Not entered"

print "Content-type:text/html\r\n\r\n"

print "<html>"

print "<head>";

print "<title>Text Area - Fifth CGI Program</title>"

print "</head>"

print "<body>"

print "<h2> Entered Text Content is %s</h2>" % text\_content

print "</body>"

## **Passing Drop Down Box Data to CGI Program**

Drop Down Box is used when we have many options available but only one or two will be selected.

Here is example HTML code for a form with one drop down box −

<form action="/cgi-bin/dropdown.py" method="post" target="\_blank">

<select name="dropdown">

<option value="Maths" selected>Maths</option>

<option value="Physics">Physics</option>

</select>

<input type="submit" value="Submit"/>

</form>

The result of this code is the following form −

Top of Form



Bottom of Form

Below is dropdown.py script to handle input given by web browser.

#!/usr/bin/python

# Import modules for CGI handling

import cgi, cgitb

# Create instance of FieldStorage

form = cgi.FieldStorage()

# Get data from fields

if form.getvalue('dropdown'):

subject = form.getvalue('dropdown')

else:

subject = "Not entered"

print "Content-type:text/html\r\n\r\n"

print "<html>"

print "<head>"

print "<title>Dropdown Box - Sixth CGI Program</title>"

print "</head>"

print "<body>"

print "<h2> Selected Subject is %s</h2>" % subject

print "</body>"

print "</html>"

## **Using Cookies in CGI**

HTTP protocol is a stateless protocol. For a commercial website, it is required to maintain session information among different pages. For example, one user registration ends after completing many pages. How to maintain user's session information across all the web pages?

In many situations, using cookies is the most efficient method of remembering and tracking preferences, purchases, commissions, and other information required for better visitor experience or site statistics.

## **How It Works?**

Your server sends some data to the visitor's browser in the form of a cookie. The browser may accept the cookie. If it does, it is stored as a plain text record on the visitor's hard drive. Now, when the visitor arrives at another page on your site, the cookie is available for retrieval. Once retrieved, your server knows/remembers what was stored.

Cookies are a plain text data record of 5 variable-length fields:

* **Expires:** The date the cookie will expire. If this is blank, the cookie will expire when the visitor quits the browser.
* **Domain:** The domain name of your site.
* **Path:** The path to the directory or web page that sets the cookie. This may be blank if you want to retrieve the cookie from any directory or page.
* **Secure:** If this field contains the word "secure", then the cookie may only be retrieved with a secure server. If this field is blank, no such restriction exists.
* **Name=Value:** Cookies are set and retrieved in the form of key and value pairs.

## **Setting up Cookies**

It is very easy to send cookies to browser. These cookies are sent along with HTTP Header before to Content-type field. Assuming you want to set UserID and Password as cookies. Setting the cookies is done as follows −

#!/usr/bin/python

print "Set-Cookie:UserID=XYZ;\r\n"

print "Set-Cookie:Password=XYZ123;\r\n"

print "Set-Cookie:Expires=Tuesday, 31-Dec-2007 23:12:40 GMT";\r\n"

print "Set-Cookie:Domain=www.tutorialspoint.com;\r\n"

print "Set-Cookie:Path=/perl;\n"

print "Content-type:text/html\r\n\r\n"

...........Rest of the HTML Content....

From this example, you must have understood how to set cookies. We use **Set-Cookie** HTTP header to set cookies.

It is optional to set cookies attributes like Expires, Domain, and Path. It is notable that cookies are set before sending magic line **"Content-type:text/html\r\n\r\n**.

## **Retrieving Cookies**

It is very easy to retrieve all the set cookies. Cookies are stored in CGI environment variable HTTP\_COOKIE and they will have following form −

key1=value1;key2=value2;key3=value3....

Here is an example of how to retrieve cookies.

#!/usr/bin/python

# Import modules for CGI handling

from os import environ

import cgi, cgitb

if environ.has\_key('HTTP\_COOKIE'):

for cookie in map(strip, split(environ['HTTP\_COOKIE'], ';')):

(key, value ) = split(cookie, '=');

if key == "UserID":

user\_id = value

if key == "Password":

password = value

print "User ID = %s" % user\_id

print "Password = %s" % password

This produces the following result for the cookies set by above script −

User ID = XYZ

Password = XYZ123

## **File Upload Example**

To upload a file, the HTML form must have the enctype attribute set to**multipart/form-data**. The input tag with the file type creates a "Browse" button.

<html>

<body>

<form enctype="multipart/form-data"

action="save\_file.py" method="post">

<p>File: <input type="file" name="filename" /></p>

<p><input type="submit" value="Upload" /></p>

</form>

</body>

</html>

The result of this code is the following form −

Top of Form

File:



Bottom of Form

Above example has been disabled intentionally to save people uploading file on our server, but you can try above code with your server.

Here is the script **save\_file.py** to handle file upload −

#!/usr/bin/python

import cgi, os

import cgitb; cgitb.enable()

form = cgi.FieldStorage()

# Get filename here.

fileitem = form['filename']

# Test if the file was uploaded

if fileitem.filename:

# strip leading path from file name to avoid

# directory traversal attacks

fn = os.path.basename(fileitem.filename)

open('/tmp/' + fn, 'wb').write(fileitem.file.read())

message = 'The file "' + fn + '" was uploaded successfully'

else:

message = 'No file was uploaded'

print """\

Content-Type: text/html\n

<html>

<body>

<p>%s</p>

</body>

</html>

""" % (message,)

If you run the above script on Unix/Linux, then you need to take care of replacing file separator as follows, otherwise on your windows machine above open() statement should work fine.

fn = os.path.basename(fileitem.filename.replace("\\", "/" ))

**Apache Server:**

**Please install Apache server from :** [**http://archive.apache.org/dist/httpd/binaries/win32/httpd-2.2.16-win32-x86-no\_ssl.msi**](http://archive.apache.org/dist/httpd/binaries/win32/httpd-2.2.16-win32-x86-no_ssl.msi)