Python – Socket Programing and Networking

Python provides two levels of access to network services. At a low level, you can access the basic socket support in the underlying operating system, which allows you to implement clients and servers for both connection-oriented and connectionless protocols.

Python also has libraries that provide higher-level access to specific application-level network protocols, such as FTP (file transfer protocol), HTTP (hypertext transfer protocol), and so on.

This chapter gives you understanding on most famous concept in Networking - Socket Programming.

What is Sockets?

Sockets are the endpoints of a bidirectional communications channel. Sockets may communicate within a process, between processes on the same machine, or between processes on different continents.

Sockets may be implemented over a number of different channel types: Unix domain sockets, TCP, UDP, and so on. The *socket* library provides specific classes for handling the common transports as well as a generic interface for handling the rest.

Sockets have their own vocabulary −

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| **Sr.No.** | **Term & Description** |
| 1 | **Domain**  The family of protocols that is used as the transport mechanism. These values are constants such as AF\_INET, PF\_INET, PF\_UNIX, PF\_X25, and so on. |
| 2 | **Type**  The type of communications between the two endpoints, typically SOCK\_STREAM for connection-oriented protocols and SOCK\_DGRAM for connectionless protocols. |
| 3 | **protocol**  Typically zero, this may be used to identify a variant of a protocol within a domain and type. |
| 4 | **hostname**  The identifier of a network interface −   * A string, which can be a host name, a dotted-quad address, or an IPV6 address in colon (and possibly dot) notation * A string "<broadcast>", which specifies an INADDR\_BROADCAST address. * A zero-length string, which specifies INADDR\_ANY, or * An Integer, interpreted as a binary address in host byte order. |
| 5 | **port**  Each server listens for clients calling on one or more ports. A port may be a Fixnum port number, a string containing a port number, or the name of a service. |

The *socket* Module

To create a socket, you must use the *socket.socket()* function available in *socket* module, which has the general syntax −

s = socket.socket (socket\_family, socket\_type, protocol=0)

Here is the description of the parameters −

* **socket\_family** − This is either AF\_UNIX or AF\_INET, as explained earlier.
* **socket\_type** − This is either SOCK\_STREAM or SOCK\_DGRAM.
* **protocol** − This is usually left out, defaulting to 0.

Once you have *socket* object, then you can use required functions to create your client or server program. Following is the list of functions required −

Server Socket Methods

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| --- | --- |
| **Sr.No.** | **Method & Description** |
| 1 | **s.bind()**  This method binds address (hostname, port number pair) to socket. |
| 2 | **s.listen()**  This method sets up and start TCP listener. |
| 3 | **s.accept()**  This passively accept TCP client connection, waiting until connection arrives (blocking). |

Client Socket Methods

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| **Sr.No.** | **Method & Description** |
| 1 | **s.connect()**  This method actively initiates TCP server connection. |

General Socket Methods

|  |  |
| --- | --- |
| **Sr.No.** | **Method & Description** |
| 1 | **s.recv()**  This method receives TCP message |
| 2 | **s.send()**  This method transmits TCP message |
| 3 | **s.recvfrom()**  This method receives UDP message |
| 4 | **s.sendto()**  This method transmits UDP message |
| 5 | **s.close()**  This method closes socket |
| 6 | **socket.gethostname()**  Returns the hostname. |

A Simple Server

To write Internet servers, we use the **socket** function available in socket module to create a socket object. A socket object is then used to call other functions to setup a socket server.

Now call **bind(hostname, port)** function to specify a *port* for your service on the given host.

Next, call the *accept* method of the returned object. This method waits until a client connects to the port you specified, and then returns a *connection* object that represents the connection to that client.

#!/usr/bin/python # This is server.py file

import socket # Import socket module

s = socket.socket() # Create a socket object

host = socket.gethostname() # Get local machine name

port = 12345 # Reserve a port for your service.

s.bind((host, port)) # Bind to the port

s.listen(5) # Now wait for client connection.

while True:

c, addr = s.accept() # Establish connection with client.

print 'Got connection from', addr

c.send('Thank you for connecting')

c.close() # Close the connection

A Simple Client

Let us write a very simple client program which opens a connection to a given port 12345 and given host. This is very simple to create a socket client using Python's *socket* module function.

The **socket.connect(hosname, port )** opens a TCP connection to *hostname*on the *port*. Once you have a socket open, you can read from it like any IO object. When done, remember to close it, as you would close a file.

The following code is a very simple client that connects to a given host and port, reads any available data from the socket, and then exits −

#!/usr/bin/python # This is client.py file

import socket # Import socket module

s = socket.socket() # Create a socket object

host = socket.gethostname() # Get local machine name

port = 12345 # Reserve a port for yo ur service.

s.connect((host, port))

print s.recv(1024)

s.close # Close the socket when done

Now run this server.py in background and then run above client.py to see the result.

# Following would start a server in background.

$ python server.py &

# Once server is started run client as follows:

$ python client.py

This would produce following result −

Got connection from ('127.0.0.1', 48437)

Thank you for connecting

Python Internet modules

A list of some important modules in Python Network/Internet programming.

|  |  |  |  |
| --- | --- | --- | --- |
| **Protocol** | **Common function** | **Port No** | **Python module** |
| HTTP | Web pages | 80 | httplib, urllib, xmlrpclib |
| NNTP | Usenet news | 119 | nntplib |
| FTP | File transfers | 20 | ftplib, urllib |
| SMTP | Sending email | 25 | smtplib |
| POP3 | Fetching email | 110 | poplib |
| IMAP4 | Fetching email | 143 | imaplib |
| Telnet | Command lines | 23 | telnetlib |
| Gopher | Document transfers | 70 | gopherlib, urllib |

Please check all the libraries mentioned above to work with FTP, SMTP, POP, and IMAP protocols.