

Python - Network Programming

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, HTTP, 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 –

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 – <ul style="list-style-type: none"> • 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

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

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(hostname, 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 your 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.

Further Readings

This was a quick start with Socket Programming. It is a vast subject. It is recommended to go through the following link to find more detail –

- [Unix Socket Programming](#) .
- [Python Socket Library and Modules](#) .