AdHOC NETWORKS

Python 2 and Python 3

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“Python design philosophy emphasizes code readability”

INTRODUCTION

Python is a high-level, interpreted, interactive and object oriented-scripting language.

- **Python is Interpreted**
- **Python is Compiled**
- **Python is Interactive**
- **Python is Object-Oriented**
- **Python is Beginner's Language**

Python was developed by Guido van Rossum in the late eighties and early nineties at the National Research Institute for Mathematics and Computer Science in the Netherlands.

Python's feature highlights include:

- **Easy-to-learn**
- **Easy-to-read**
- **Easy-to-maintain**
- **A broad standard library**
- **Interactive Mode**
- **Portable**
- **Extendable**
- **Databases**
- **GUI Programming**
- **Scalable**

Python supports multiple programming paradigms, including object-oriented, imperative and functional programming styles. It features a fully dynamic type system and automatic memory management, similar to that of Scheme, Ruby, Perl, and Tcl. Like other dynamic languages, Python is often used as a scripting language, but is also used in a wide range of non-scripting contexts. Using third-party tools, Python code can be packaged into standalone executable programs. Python interpreters are available for many operating systems.

What you need to get started:-

Python 3 (python.org/download)

Most stable release of python is 2.6.5 and 3.1.2

Note: -Python 3.x code is NOT backward-compatible with python 2.x

For example, in python 2, for printing a text, you can

```
>>> print “adhoc”
```

But in python 3, for printing a text, you have to put parenthesis

```
>>> print (“adhoc”)
```

Imp: you can install python2 and python3 both version on one computer without any trouble

What can you do with python?

- System admin / automation
- Database/ n/w / internet access
- GUI development – games
- Science and math programming
- HW / SW testing
- Hacking task and penetration testing tools

Examples of Python Applications:-

Bittorrent

- YouTube
- Google (App Engine)
- Reddit
- Pixas / illustrator Magic
- NASA / Los Alamos / Fermi LAB
- Spam Bayes / Trac
- Anaconda (fedora / Redhat)

Assigning Values to Variables

Python variables do not need explicit declaration to reserve memory space. The declaration happens automatically when you assign a value to a variable. The equal sign (=) is used to assign values to variables.

For example:

```
ashutoshh@ashulinux:~$ python
Python 2.7.6 (default, Jun 22 2015, 17:58:13)
[GCC 4.8.2] on linux2
Type "help", "copyright", "credits" or "license" for more information.
>>>
>>> a=45
>>> b="Redhat"
>>> c=5.4
>>>print a
45
>>>print b
Redhat
>>>print c
5.4
```

Standard Data Types

The data stored in memory can be of many types. For example, a person's age is stored as a numeric value and his or her address is stored as alphanumeric characters. Python has various standard data types that are used to define the operations possible on them and the storage method for each of them.

i) **Integer**

ii) String

iii) float

iv) tuple

v) list

vi) Dictionary

MUTABLE VS. IMMUTABLE

MUTABILITY OF COMMON TYPES

The way I like to remember which types are mutable and which are not is that containers and user-defined types are generally mutable while everything else is immutable. Then I just remember the exceptions like tuple which is an immutable container and frozen set which is an immutable version of set (which makes sense, so you just have to remember tuple).

The following are immutable **objects:**

•Numeric types: int, float, complex
•string
•tuple
•frozen set
•bytes

The following objects are mutable**:**

•list
•dict
•set
•byte array

Basic Operation upon Integer and Float.

Note: basic operation include listed here

```
ashutoshh@ashulinux:~$ python
Python 2.7.6 (default, Jun 22 2015, 17:58:13)
[GCC 4.8.2] on linux2
Type "help", "copyright", "credits" or "license" for more information.
>>>
>>>
>>> a=90
>>> b=3
>>> c=12
```

```
>>>
>>>a + b
93
>>> a - c
78
>>> a * b
270
>>> a /3
30
>>> a / b
30
>>> a % b
0
```

Printing Message and taking Inputfrom users:

```
ashutoshh@ashulinux:~$ python
Python 2.7.6 (default, Jun 22 2015, 17:58:13)
[GCC 4.8.2] on linux2
Type "help", "copyright", "credits" or "license" for more information.
>>>
>>>print “Hello world!! "
Hello world!!
>>>
>>>print “Hello world!! \n"
Hello world!!
```

User INPUT:

Python2 using raw_input() for input

```
ashutoshh@ashulinux:~$ python
```

```
Python 2.7.6 (default, Jun 22 2015, 17:58:13)

[GCC 4.8.2] on linux2

Type "help", "copyright", "credits" or "license" for more information.

>>>

>>> raw_input("Enter your data:    ")

Enter your data:    56

'56'                                    --- >> By default data type is string

>>> raw_input("Enter your data:    ")

Enter your data:    hello

'hello'

>>> x=raw_input("Enter your data:    ")


Enter your data:    56

>>> type(x)

<type 'str'>

>>> print   x

56

>>> y=int(x)   (converting from string to Integer)

>>>print y

56

>>>print type(y)

<type 'int'>

>>>
```

String Manipulation:

we can perform lots of operation upon string but some most used operation listed here

```
ashutoshh@ashulinux:~$

ashutoshh@ashulinux:~$ python

Python 2.7.6 (default, Jun 22 2015, 17:58:13)

[GCC 4.8.2] on linux2

Type "help", "copyright", "credits" or "license" for more information.

>>>

>>> s="this is testing python"

>>>print s

this is testing python

>>>
```

i) Length count

```
>>> len(s)

25
```

ii) String Formatting Operator

One of Python's coolest features is the string format operator %. This operator is unique to strings and makes up for the pack of having functions from C's printf() family. Following is a simple example −

```
>>> x="Linux"

>>>

>>>print “python can run over %s" % (x)

python can run over Linux

>>>
```

Format Symbol	Conversion
%c	character
%s	string conversion via str() prior to formatting
%i	signed decimal integer
%d	signed decimal integer
%u	unsigned decimal integer
%o	octal integer
%x	hexadecimal integer (lowercase letters)
%X	hexadecimal integer (UPPERcase letters)
%e	exponential notation (with lowercase 'e')
%E	exponential notation (with UPPERcase 'E')
%f	floating point real number
%g	the shorter of %f and %e
%G	the shorter of %f and %E

Iii) Built-in String Methods

a) counting for substring

```
>>> s="new data generated"

>>>

>>> s.count("e")

4

>>> s.count("e",0,4)

1
```

b) String Indexing

```
>>> s
'new data generated'
>>>
>>>print  s[0]
n
>>>print  s[3]
>>> print  s[5]
a
>>> print  s[0:7]
new dat
>>> print  s[0:]
new data generated
>>>
```

c) string splitting

```
>>> s
'new data generated'
>>> s.split(" ")
['new', 'data', 'generated']
>>>
```

Note: Here Iseparated with “ ” space

d) string repetition

```
>>> s
'new data generated'
>>> print  s*5
```

```
new data generatednew data generatednew data generatednew data generatednew data generated

>>>
```

e) String replace

```
>>> s

'new data generated'

>>> s.replace("data","logs")

'new logs generated'

>>>
```

f) String Join function

```
>>> s

'new data generated'

>>> print  " ".join(s)

n e w   d a t a   g e n e r a t e d

>>>
```

Note: here every character of string is joining with space

g) Strip

Python strings have the strip(), lstrip(), rstrip() methods for removing

any character from both ends of a string. If the characters to be removed are not specified then white-space will be removed

```
>>> s=" hey  i don't  know  "

>>> s.strip(" ")

"hey  i don't  know"

>>> s.strip("\n")

" hey  i don't  know  "

>>> s.lstrip()

"hey  i don't  know  "
```

```
>>>

>>> s.rstrip()

" hey  i don't  know"

>>>
```

Note:

strip() ....>> remove from both side

lstrip() .... >> remove from starting

rstrip() ....>> remove from endpoints

h) string concatenation

```
>>> s

" hey  i don't  know  "

>>>

>>> x=" who are you..??"

>>>

>>> s +  x

" hey  i don't  know   who are you..??"

>>>
```

Tuple:

This is collection of multiple values of homogeneous or heterogeneous values

>>> y=(1,4,66,"redhat")

checking type of variable

```
>>> type(y)

<type 'tuple'>
```

checking length

```
>>> len(y)

4
```

Some basic operations

i)   Indexing of tuple

```
>>> y[0]
```

```
1

>>> y[0:3]

(1, 4, 66)

>>>
```

ii) Adding tuple

```
>>> x=(23,7,"new line")

>>>

>>> y=(55,"this is",222)

>>> x + y

(23, 7, 'new line', 55, 'this is', 222)

>>>
```

iii) Searching in tuple

```
>>> x

(23, 7, 'new line')

>>> 7 in  x

True

>>>
```

<u>List:</u>

this is collection of homogeneous or heterogeneous value which support mutability

```
ashutoshh@ashulinux:~$ python

Python 2.7.6 (default, Jun 22 2015, 17:58:13)

[GCC 4.8.2] on linux2

Type "help", "copyright", "credits" or "license" for more information.

>>>

>>> a=[2,4,"hiii",6.4]

>>> type(a)

<type 'list'>

>>>
```

Some Basic Operations

```
>>> a=[2,4,"hiii",6.4]
```

type checking

```
>>> type(a)

<type 'list'>
```

Indexing of list

```
>>> print   a[0]

2

>>>

>>> print   a[0:3]

[2, 4, 'hiii']

>>> print   a[0:2]

[2, 4]

>>>
```

length count

```
>>> len(a)

4
```

Insert and append in list

```
>>> a

[2, 4, 'hiii', 6.4]

>>> a.append(7)

>>> a

[2, 4, 'hiii', 6.4, 7]

>>>

>>> a.insert("me",1)

Traceback (most recent call last):

  File "<stdin>", line 1, in <module>

TypeError: an integer is required

>>> a.insert(1,"me")

>>> a

[2, 'me', 4, 'hiii', 6.4, 7]
```

```
>>>
```

Dictionary:

A dictionary optimizes element lookups. It associates keys to values. Each key must have a value. Dictionaries are used in many programs.

With square brackets, we assign and access a value at a key. With get() we can specify a default result. Dictionaries are fast. We create, mutate and test them

Instead: We can use the get() method with one or two arguments. This does not cause any annoying errors. It returns None.

Argument 1: The first argument to get() is the key you are testing.

This argument is required.

Argument 2: The second, optional argument to get() is the default

value. This is returned if the key is not found.

```
ashutoshh@ashulinux:~$ python

Python 2.7.6 (default, Jun 22 2015, 17:58:13)

[GCC 4.8.2] on linux2

Type "help", "copyright", "credits" or "license" for more
information.

>>> d={}

>>> d[0]="zero"

>>> d[1]="hello"

>>> d[2]=4545
```

```
>>>

>>> d

{0: 'zero', 1: 'hello', 2: 4545}

>>> type(d)

<type 'dict'>



>>>

<type 'dict'>
```

It’s a combination of keys and values pair

What are Conditions in python

Conditions tests if a something is True or False, and it uses Boolean

values

(type bool) to check that.

You see that conditions are either True or False (with no quotes!).

Note: for terminating condition in python you need to place (:) at the end.

```
>>> if  23  > 5 :

...     print  "hello world"

... else :

...     print  "no hello world"

...

hello world
```

Important: python follow Indentation for writing code inside loops and conditional statement.

Else if in python

```
>>> a=10

>>>

>>> if  a  <  5 :

...     print  "hiii"

... elif  a  > 5 :

...     print   "yes again !!"

... else :

...     print  "no chance"

...

yes again !!

>>>
```

While Loop in python

A conditional program that cannot be terminated if its condition goes true by default

The syntax of a while loop in Python programming language is −

while expression:
  statement(s)

```
>>> while  3  > 2 :

...     print  "hiii"

...

hiii

hiii

hiii

hiii
```

```
hiii

hiii

hiii

hiii

hiii

hiii
```

Note: this statement will always perform print operation

Another example

```
>>> while c  < 9 :
...     print  "the number is :",c
...     c = c + 1
...
the number is : 0
the number is : 1
the number is : 2
the number is : 3
the number is : 4
the number is : 5
the number is : 6
the number is : 7
the number is : 8
>>>
```

For Loop in python:

It has the ability to iterate over the items of any sequence, such as a list or a string.

Syntax:

```
for iterating_var in sequence:
   statements
```

```
>>> for  i   in   "adhoclabs":
...     print  i
...




a
d
h
o
c
l
a
b
s
```

Note: we can tuple and list variable in for loop

```
>>> primes = [2, 3, 5, 7]

>>> for prime in primes:

...     print prime

...

2

3

5

7
```

Regular-expression in Python

we are starting with python regular expression here are some examples given below.

For matching pattern we need to import a module named re (regular expression)

There are some special characters

there are two special function in regular expression for finding matches

A)   re.match ------->> find only starting of the string

B)   re.search -------->> find all the match staring to end

Important :   re.sub--------->> to find and replace

example for sub

```
>>> st1
'redhat linux one'
>>>
>>>
>>> m1=re.sub(r'redhat','LINUX',st1)
>>>
>>> m1
'LINUX linux one'
```

########### **some special character** or **Identifiers** ##############

```
\w        --  matches word  character
\W      --  matches non word character
\s       ---   matches white space
\S      ----
\d      ---   any number
.       ------  anything except  new line
```

############## **Some modifiers** #############

+   .... match 1 or more
***   ....   match 0 or more**
?   .... match o or 1
^   .... match starting of the string
$ .... match last of the string

Example 1 :

```
root@ashulinux:~# python
Python 2.7.6 (default, Jun 22 2015, 17:58:13)
[GCC 4.8.2] on linux2
Type "help", "copyright", "credits" or "license" for more information.
>>> st="welcome to redhat linux for learning"
>>>
>>> import re
>>> m=re.search("or",st)
>>> m.group()
'or'
>>> m=re.search("red",st)
>>> m.group()
'red'
```

Example 2 : **match any letter followed by "ed" in given string**

```
>>> m=re.search(".ed",st)
>>> m.group()
'red'
```
Note : here (.) indicates for matching any characters
```
>>> st
'welcome to redhat linux for learning'
>>> m=re.search("l....ing",st)
>>> m.group()
'learning'
```

Example 3: **finding all matches**

```
>>> data="redhat linux is awesome for redhat people"
>>> import re
>>> re.findall('redhat',data)
['redhat', 'redhat']
>>>
```

Function in python

A function is a block of organized, reusable code that is used to perform a single, related action. Functions provide better modularity for your application and a high degree of code reusing.

As you already know, Python gives you many built-in functions like print(), etc. but you can also create your own functions. These functions are called *user-defined functions.*

Defining a Function

You can define functions to provide the required functionality. Here are simple rules to define a function in Python.

- Function blocks begin with the keyword **def** followed by the function name and parentheses (( )).
- Any input parameters or arguments should be placed within these parentheses. You can also define parameters inside these parentheses.
- The first statement of a function can be an optional statement - the documentation string of the function or *docstring*.
- The code block within every function starts with a colon (:) and is indented.
- The statement return [expression] exits a function, optionally passing back an expression to the caller. A return statement with no arguments is the same as return None.

<u>Defining User Define Function:</u>

```
ashutoshh@ashulinux:~$ python

Python 2.7.6 (default, Jun 22 2015, 17:58:13)
```

```
[GCC 4.8.2] on linux2
Type "help", "copyright", "credits" or "license" for more information.
>>> def  ad():
...     print  "this is wat i want !1"
...     print  "i can execute multiple line"
...     print   "this is reuse of code"
...
>>> ad()
this is wat i want !1
i can execute multiple line
this is reuse of code
>>>
```

Now Function with single parameter:

```
>>> def  saysometing(x):
...     print   "hey ",x
...
>>> saysometing("rahul")
hey rahul
>>>
```

Function with Default parameter:

```
>>> def   new(x,y=10) :
...     print   x  +  y
...
>>> new(5)
15
>>> new(5,90)
95
>>>
```

Variable length argument:

```
>>> def    varl(x,*y) :
...     print  x
...     print  y
...
>>> varl(1,5)
1
(5,)
>>> varl(1,5,7,8,"redhat")
1
(5, 7, 8, 'redhat')
>>>
```

Note: here *y is a tuple

Start Write Code in Files

Python is the language where you can use **(Interpreter,compiler, IDE)**

here we are going to discuss to code in python in File

Note: You can use any Editor i am using **VI/VIM** in **Redhat Linux**.

<u>Step 1: write code like given below</u>

```
ashutoshh@ashulinux:~$ vim    code1.py
#!/usr/bin/python2
print  "Hello World !!"
```

<u>Step 2 : make it executable</u>

```
ashutoshh@ashulinux:~$ chmod   +x   code1.py
```

Step 3: Run the program

I) Method 1

```
ashutoshh@ashulinux:~$ python   code1.py
Hello World !!
```

II) Method 2

```
ashutoshh@ashulinux:~$ ./code1.py
Hello World !!
```

Modules in Python: -

A module allows you to logically organize your Python code. Grouping related code into a module makes the code easier to understand and use. A module is a Python object with arbitrarily named attributes that you can bind and reference.

Simply, a module is a file consisting of Python code. A module can define functions, classes and variables. A module can also include runnable code.

I) Using Modules in Python

for using module, you need to use import command

```
ashutoshh@ashulinux:~$ python

Python 2.7.6 (default, Jun 22 2015, 17:58:13)

[GCC 4.8.2] on linux2

Type "help", "copyright", "credits" or "license" for more information.

>>> import  os

>>> os.system('date')

Wed Mar  2 09:01:46 IST 2016

0
```

Note: here **os** is the name of module and **system** is the name of function here to use internal commands of base operating system

More with Modules

i) Describe and exploring built_in Modules

```
ashutoshh@ashulinux:~$ python

Python 2.7.6 (default, Jun 22 2015, 17:58:13)

[GCC 4.8.2] on linux2

Type "help", "copyright", "credits" or "license" for more information.

>>>

>>>import commands

>>> dir(commands)
```

```
['__all__', '__builtins__', '__doc__', '__file__', '__name__', '__package__', 'getoutput', 'getstatus', 'getstatusoutput',
'mk2arg', 'mkarg']

>>>
```

Here dir**(module_name) will** show you listed function

Using More Modules: -

i) Using commands module

To run any os related command from python interpreter

```
ashutoshh@ashulinux:~$ python

Python 2.7.6 (default, Jun 22 2015, 17:58:13)

[GCC 4.8.2] on linux2

Type "help", "copyright", "credits" or "license" for more information.

>>>

>>>import commands

>>> dir(commands)

['__all__', '__builtins__', '__doc__', '__file__', '__name__', '__package__', 'getoutput', 'getstatus', 'getstatusoutput',
'mk2arg', 'mkarg']

>>> commands.getoutput('date')

'Wed Mar  2 11:39:32 IST 2016'

>>> x=commands.getoutput('date')

>>> x

'Wed Mar  2 11:39:35 IST 2016'

>>>
```

II) Using time module

to check and change time from python this module was created

```
ashutoshh@ashulinux:~$ python

Python 2.7.6 (default, Jun 22 2015, 17:58:13)

[GCC 4.8.2] on linux2

Type"help", "copyright","credits" or "license" for more information.

>>>
```

>>> import time

>>> dir(time)

['__doc__', '__name__', '__package__', 'accept2dyear', 'altzone', 'asctime', 'clock', **'ctime**', 'daylight', 'gmtime', 'localtime', 'mktime', **'sleep**', 'strftime', 'strptime', 'struct_time', 'time', 'timezone', 'tzname', 'tzset']

>>> time.ctime()

'Wed Mar 2 11:41:26 2016'

>>>

>>> time.clock()

0.024445

>>> time.timezone

-19800

>>> time.sleep(5)   ...>>>>>>>>>. wait for 5 second to interpreter

III) Using math module

>>> import math

>>> dir(math)

['__doc__', '__name__', '__package__', 'acos', 'acosh', 'asin', 'asinh', 'atan', 'atan2', 'atanh', 'ceil', 'copysign', 'cos', 'cosh', 'degrees', 'e', 'erf', 'erfc', 'exp', 'expm1', 'fabs', '**factorial**', 'floor', 'fmod', 'frexp', 'fsum', 'gamma', 'hypot', 'isinf', 'isnan', 'ldexp', 'lgamma', 'log', **'log10**', 'log1p', 'modf', 'pi', 'pow', 'radians', 'sin', 'sinh', **'sqrt'**, 'tan', 'tanh', 'trunc']

>>> math.sin(45)

0.8509035245341184

>>> math.sin(90)

0.8939966636005579

>>> math.sin(0)

0.0

>>> math.sqrt(36)

6.0

>>>

>>> math.factorial(4)

```
24

>>> math.log(10)

2.302585092994046

>>>
```

IV) Working with sys module

```
ashutoshh@ashulinux:~$ python

Python 2.7.6 (default, Jun 22 2015, 17:58:13)

[GCC 4.8.2] on linux2

Type "help", "copyright", "credits" or "license" for more information.

>>> import  sys

>>> dir(sys)

['__displayhook__', '__doc__', '__excepthook__', '__name__', '__package__', '__stderr__', '__stdin__', '__stdout__',
'_clear_type_cache', '_current_frames', '_getframe', '_mercurial', '_multiarch', 'api_version', 'argv',
'builtin_module_names', 'byteorder', 'call_tracing', 'callstats', 'copyright', 'displayhook', 'dont_write_bytecode',
'exc_clear', 'exc_info', 'exc_type', 'excepthook', 'exec_prefix', 'executable', 'exit', 'flags', 'float_info', 'float_repr_style',
'getcheckinterval', 'getdefaultencoding', 'getdlopenflags', 'getfilesystemencoding', 'getprofile', 'getrecursionlimit',
'getrefcount', 'getsizeof', 'gettrace', 'hexversion', 'long_info', 'maxint', 'maxsize', 'maxunicode', 'meta_path', 'modules',
'path', 'path_hooks', 'path_importer_cache', 'platform', 'prefix', 'ps1', 'ps2', 'py3kwarning', 'pydebug',
'setcheckinterval', 'setdlopenflags', 'setprofile', 'setrecursionlimit', 'settrace', 'stderr', 'stdin', 'stdout', 'subversion',
'version', 'version_info', 'warnoptions']

>>>

>>> sys.version           ...>> checking  version  of  python


'2.7.6 (default, Jun 22 2015, 17:58:13) \n[GCC 4.8.2]'

>>> sys.path         ..........>>   python  path and environment variable


['', '/usr/lib/python2.7', '/usr/lib/python2.7/plat-x86_64-linux-gnu', '/usr/lib/python2.7/lib-tk', '/usr/lib/python2.7/lib-
old', '/usr/lib/python2.7/lib-dynload', '/usr/local/lib/python2.7/dist-packages', '/usr/lib/python2.7/dist-packages',
'/usr/lib/python2.7/dist-packages/PILcompat', '/usr/lib/python2.7/dist-packages/gtk-2.0',
'/usr/lib/pymodules/python2.7', '/usr/lib/python2.7/dist-packages/ubuntu-sso-client']
```

>>> sys.argv ....>> for using inline input

['']

Making own modules:

Now here we are going to create own module like python built-in

Step 1 : create a file and write code

```
ashutoshh@ashulinux:~$ vim   mycal.py

#!/usr/bin/python2
def   ad():
        print  " Welcome to adhoclabs summer training !! "
        print  "Enjoy  the pace and power of python and linux"
def   add(x,y):
        return  x  +  y
def    mul(x,y,z):
        print   x  *  y  *  z
def    motd():
        print   "This is message of the Day !!"
```

Step 2:Importing the module

```
ashutoshh@ashulinux:~$ python
Python 2.7.6 (default, Jun 22 2015, 17:58:13)
[GCC 4.8.2] on linux2
Type "help", "copyright", "credits" or "license" for more information.
>>> import  mycal
>>> dir(mycal)
['__builtins__', '__doc__', '__file__', '__name__', '__package__', 'add', 'ad', 'motd', 'mul']
>>>
ashutoshh@ashulinux:~$ python
Python 2.7.6 (default, Jun 22 2015, 17:58:13)
[GCC 4.8.2] on linux2
Type "help", "copyright", "credits" or "license" for more information.
>>> import  mycal
>>> dir(mycal)
['__builtins__', '__doc__', '__file__', '__name__', '__package__', 'add', 'ad', 'motd', 'mul']
>>> mycal.ad()
 Welcome to adhoclabs summer training !!
Enjoy  the pace and power of python and linux
>>>
>>> mycal.add(4,6)
10
```

File Handling in Python:-

File is a named location on disk to store related information. It is used to permanently store data in a non-volatile memory (e.g. hard disk). Since, random access memory (RAM) is volatile which loses its data when computer is turned off, we use files for future use of the data.

When we want to read from or write to a file we need to open it first. When we are done, it needs to be closed, so that resources that are tied with the file are freed. Hence, in Python, a file operation takes place in the following order.

1. **Open file**
2. **read / write / append (operation)**
3. **Close file**

Opening a File

Python has a built-in function open() to open a file. This function returns a file object, also called a handle, as it is used to read or modify the file accordingly

```
ashutoshh@ashulinux:~$ python
Python 2.7.6 (default, Jun 22 2015, 17:58:13)
[GCC 4.8.2] on linux2
Type "help", "copyright", "credits" or "license" for more information.
>>>
>>> f=open('mycal.py','r')     ....>> here  file is open in read mode
>>> f.read()
```

```
'#!/usr/bin/python2\n\ndef   ad():\n\n\tprint  " Welcome to adhoclabs summer training !! "\n\tprint  "Enjoy  the pace and power of python and linux"\n\n\ndef   add(x,y):\n\treturn  x  +  y\n\n\ndef    mul(x,y,z):\n\tprint   x  *  y  * z\n\n\ndef    motd():\n\tprint   "This is message of the Day !!"\n\n\n\n\n'

>>> f.close()
```

Note:

We can specify the mode while opening a file. In mode, we specify whether we want to read 'r', write 'w' or append 'a' to the file. We also specify if we want to open the file in text mode or binary mode. The default is reading in text mode. In this mode, we get strings when reading from the file. On the other hand, binary mode returns bytes and this is the mode to be used when dealing with non-text files like image or exe files

Mode	**Description**
'r'	open file for reading purpose only
'w'	open file only for write purpose
'r+'	open file for read and write purpose but in this case file must be exists
'w+'	open file for read and write purpose but in this case file is not present the file will be created
'a'	It will create a file and open this in append mode but you cannot read
'a+'	It will create a file and open this in append mode but you can read also

Examples:

i) open a file in write mode

```
ashutoshh@ashulinux:~$ python

Python 2.7.6 (default, Jun 22 2015, 17:58:13)

[GCC 4.8.2] on linux2
```

```
Type "help", "copyright", "credits" or "license" for more information.

>>>

>>> f=open('hiii.txt','w')

>>> f.write("count the days its not easy for u \n")

>>> f.write("knowledge is power \n")

>>> f.close()

>>>
```

II) open file for reading purpose

```
>>> f=open('hiii.txt','r')

>>> f.read()

'count the days its not easy for u \nknowledge is power \n'

>>> f.read()

''
```

>>> f.seek(0)   ....>> sending pointer to first character

```
>>>

>>> f.readlines()

['count the days its not easy for u \n', 'knowledge is power \n']

>>>
```

Exception handling in Python:

When writing a program, we, more often than not, will encounter errors. Error caused by not following the proper structure (syntax) of the language is called syntax error or parsing error

Example :

```
ashutoshh@ashulinux:~$ python

Python 2.7.6 (default, Jun 22 2015, 17:58:13)
```

```
[GCC 4.8.2] on linux2

Type "help", "copyright", "credits" or "license" for more information.

>>>

>>> if  a  < 3

  File "<stdin>", line 1

    if  a  < 3

           ^

SyntaxError: invalid syntax

>>> 23  / 0

Traceback (most recent call last):

  File "<stdin>", line 1, in <module>

ZeroDivisionError: integer division or modulo by zero

>>>
```

Note: this kind of error will generate which can be logical or syntax error

Important: There is different kind of error in python and some of them are listed below:

Assertion Error : Raised when assert statement fails.

Attribute Error : Raised when attribute assignment or reference fails.

EOF Error :Raised when the input() functions hits end-of-file condition.

Floating Point Error : Raised when a floating point operation fails.

Generator Exit :Raise when a generator's close() method is called.

Import Error :Raised when the imported module is not found.

Index Error	:Raised when index of a sequence is out of range.
Key Error	: Raised when a key is not found in a dictionary.
Keyboard Interrupt	: Raised when the user hits interrupt key (Ctrl+c or delete).
Memory Error	: Raised when an operation runs out of memory.
Name Error	:Raised when a variable is not found in local or global scope.
Not Implemented Error	:Raised by abstract methods.
OS Error	: Raised when system operation causes system related error.
Over flow Error	: Raised when result of an arithmetic operation is too large to be represented.
Reference Error	:Raised when a weak reference proxy is used to access a garbage collected referent.
Runtime Error	:Raised when an error does not fall under any other category.
Stop Iteration	:Raised by next() function to indicate that there is no further item to be returned by iterator.
Syntax Error	:Raised by parser when syntax error is encountered.
Indentation Error	:Raised when there is incorrect indentation.
Tab Error	:Raised when indentation consists of inconsistent tabs and spaces.
System Error	:Raised when interpreter detects internal error.
System Exit	:Raised by sys.exit() function.
Type Error :	Raised when a function or operation is applied to an object of incorrect type.
Unbound Local Error	:Raised when a reference is made to a local variable in a function or method, but no value has been bound to that variable.
Unicode Error	:Raised when a Unicode-related encoding or decoding error occurs.

Value Error :Raised when a function gets argument of correct type but improper value.

Zero Division Error :Raised when second operand of division or modulo operation is zero.

Python Exception Handling - Try, Except and Finally

When an exception occurs in Python, it causes the current process to stop and passes it to the calling process until it is handled. If not handled, our program will crash. For example, if function Acalls function B which in turn calls function C and an exception occurs in function C. If it is not handled in C, the exception passes to B and then to A. If never handled, an error message is spit out and our program come to a sudden, unexpected halt

Catching any Exceptions in Python

In Python, exceptions can be handled using a try statement. A critical operation which can raise exception is placed inside the try clause and the code that handles exception is written in except clause. It is up to us, what operations we perform once we have caught the exception. Here is a simple example.

```
ashutoshh@ashulinux:~$ python

Python 2.7.6 (default, Jun 22 2015, 17:58:13)

[GCC 4.8.2] on linux2

Type "help", "copyright", "credits" or "license" for more information.

>>>

>>> try :

...     if  45 :

...             23 / 0

...     elif  True :

...             "redhat" + 56

... except :

...     print  "error is handled by default !!"

...

error is handled by default !!
```

Catching Specific Exceptions in Python:

In the above example, we did not mention any exception in the except clause. This is not a good programming practice as it will catch all exceptions and handle every case in the same way. We can specify which exceptions an except clause will catch. A try clause can have any number of except clause to handle them differently but only one will be executed in case an exception occurs. We can use a tuple of values to specify multiple exceptions in an except clause. Here is an example pseudo code

```
>>> try :
...     78 / 0
...     import  skdfjdslkf
...     "redhat india"  +  45
... except ZeroDivisionError:
...     print  "zero division error !!"
... except (TypeError,ImportError) :
...     print   "new error found !!! "
...
zero division error !!
>>>
```

try...finally

The try statement in Python can have an optional finally clause. This clause is executed no matter what, and is generally used to release external resources. For example, we may be connected to a remote data center through the network or working with a file or working with a Graphical User Interface (GUI). In all these circumstances, we must clean up the resource once used, whether it was successful or not. These actions (closing a file, GUI or disconnecting from network) are performed in the finally clause to guarantee execution.

```
ashutoshh@ashulinux:~$ python
Python 2.7.6 (default, Jun 22 2015, 17:58:13)
[GCC 4.8.2] on linux2
Type "help", "copyright", "credits" or "license" for more information.
>>>
>>> try :
...     print   5445
... except :
...     45 / 0
... finally
...     print  "hello world"
...
5445
hello world
```

Python Socket Programming

I’m only going to talk about INET sockets, but they account for at least 99% of the sockets in use. And I’ll only talk about STREAM sockets - unless you really know what you’re doing (in which case this HOWTO isn’t for you!), you’ll get better behaviour and performance from a STREAM socket than anything else. I will try to clear up the mystery of what a socket is, as well as some hints on how to work with blocking and non-blocking sockets. But I’ll start by talking about blocking sockets. You’ll need to know how they work before dealing with non-blocking sockets.

Part of the trouble with understanding these things is that “socket” can mean a number of subtly different things, depending on context. So first, let’s make a distinction between a “client” socket - an endpoint of a conversation, and a “server” socket, which is more like a switchboard operator. The client application (your browser, for example) uses “client” sockets exclusively; the web server it’s talking to uses both “server” sockets and “client” sockets.

What is Socket...??

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.

Creating UDPsocket: -

Here we are taking a server and Client example

<u>AT Server Side:</u>

```
ashutoshh@ashulinux:~$ python
```

```
Python 2.7.6 (default, Jun 22 2015, 17:58:13)

[GCC 4.8.2] on linux2


Type "help", "copyright", "credits" or "license" for more information.

>>>

>>> import  socket

>>> s=socket.socket(socket.AF_INET,socket.SOCK_DGRAM)  ....>>creating socket

>>> s.bind(("192.168.0.104",9999))    ....>>Binding socket

>>> s.recvfrom(100)           ..........>>>receiving data
```

AT Client Side

```
ashutoshh@ashulinux:~$ python

Python 2.7.6 (default, Jun 22 2015, 17:58:13) [GCC 4.8.2] on linux2

Type "help", "copyright", "credits" or "license" for more information.

>>> import  socket

>>> s=socket.socket(socket.AF_INET,socket.SOCK_DGRAM)

>>> s.sendto("hiii",("192.168.0.104",9999))

4
```

Now go to server side and check for message:

```
>> s.recvfrom(100)

('hiii', ('192.168.0.104', 48246))

>>>
```

Tcp socket:

socket.socket(): Create a new socket using the given address family, socket type and protocol number.

socket.bind(address): Bind the socket to **address**.
socket.listen(backlog): Listen for connections made to the socket. The **backlog** argument specifies the maximum number of queued connections and should be at least 0; the maximum value is system-dependent (usually 5), the minimum value is forced to 0.
socket.accept(): The return value is a pair **(conn, address)** where **conn** is a new socket object usable to send and receive data on the connection, and **address** is the address bound to the socket on the other end of the connection.

At **accept()**, a new socket is created that is distinct from the named socket. This new socket is used solely for communication with this particular client.

For TCP servers, the socket object used to receive connections is not the same socket used to perform subsequent communication with the client. In particular, the **accept()**system call returns a new socket object that's actually used for the connection. This allows a server to manage connections from a large number of clients simultaneously.

- **socket.send(bytes[, flags])**: Send data to the socket. The socket must be connected to a remote socket. Returns the number of **bytes** sent. Applications are responsible for checking that all data has been sent; if only some of the data was transmitted, the application needs to attempt delivery of the remaining data.
- **socket.colse()**: Mark the socket closed. all future operations on the socket object will fail. The remote end will receive no more data (after queued data is flushed). Sockets are automatically closed when they are garbage-collected, but it is recommended to close() them explicitly.

Note that the **server** socket doesn't receive any data. It just produces **client** sockets. Each**clientsocket** is created in response to some other **client** socket doing a **connect()** to the host and port we're bound to. As soon as we've created that **clientsocket**, we go back to listening for more connections.

```
# server.py

import socket

import time

# create a socket object

serversocket = socket.socket(

socket.AF_INET, socket.SOCK_STREAM)

# get local machine name

host = socket.gethostname()

port = 9999

# bind to the port

serversocket.bind((host, port))

# queue up to 5 requests

serversocket.listen(5)
```

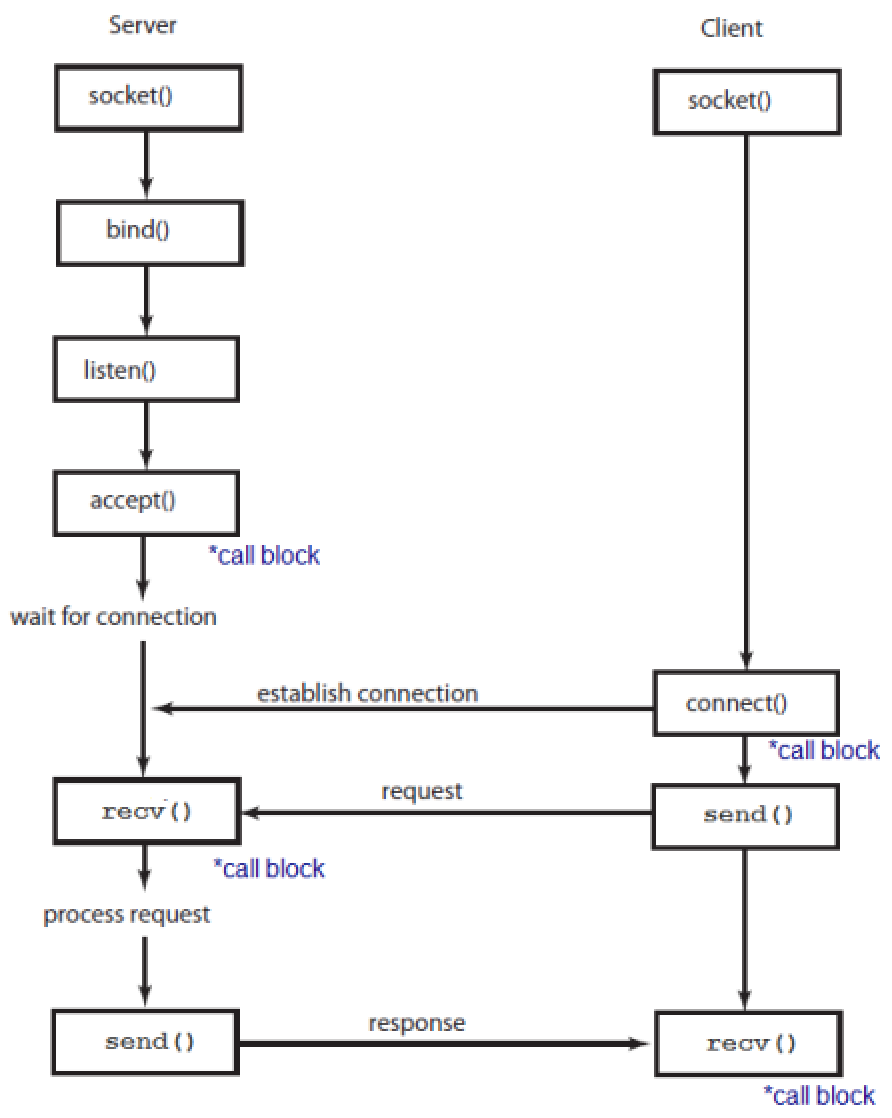
```
while True:
# establish a connection
clientsocket,addr = serversocket.accept()
print("Got a connection from %s" % str(addr))
currentTime = time.ctime(time.time()) + "\r\n"
clientsocket.send(currentTime.encode('ascii'))
clientsocket.close()
```

Client Side :

```
# client.py
import socket
# create a socket object
s = socket.socket(socket.AF_INET, socket.SOCK_STREAM)
# get local machine name
host = socket.gethostname()
port = 9999
# connection to hostname on the port.
s.connect((host, port))
# Receive no more than 1024 bytes
tm = s.recv(1024)
s.close()
print("The time got from the server is %s" % tm.decode('ascii'))
```

The output from the run should look like this:

```
ashutoshh@ashulinux:~$ python server.py &
Got a connection from ('127.0.0.1', 54597)
ashutoshh@ashulinux:~$ python client.py
The time got from the server is Wed Jan 29 19:14:15 2014
```


Server
Client
socket()
socket()
bind()
listen()
accept()
*call block
wait for connection
establish connection
connect()
*call block
recv()
request
send()
*call block
process request
send()
response
recv()
*call block

Getting started with Python 3:

Python 3.0 final was released on December 3rd, 2008.

Python 3.0 (a.k.a. "Python 3000" or "Py3k") is a new version of the language that is incompatible with the 2.x line of releases. The language is mostly the same, but many details, especially how built-in objects like dictionaries and strings work, have changed considerably, and a lot of deprecated features have finally been removed. Also, the standard library has been reorganized in a few prominent places.

Note: You can download python setup from “python.org/download**”**

Important: IN python 3 everything is Object this is one of the Language which is

100 % ObjectOriented

Some Basic Difference in Python 2 and Python3:

i) Print Function:

```
ashutoshh@ashulinux:~$ python3
Python 3.4.3 (default, Oct 14 2015, 20:28:29)
[GCC 4.8.4] on linux
Type "help", "copyright", "credits" or "license" for more information.
>>>
>>> print("Hello world !! ")
Hello world !!
>>>
```

II) User Input in python

```
ashutoshh@ashulinux:~$ python3
Python 3.4.3 (default, Oct 14 2015, 20:28:29)
[GCC 4.8.4] on linux
Type "help", "copyright", "credits" or "license" for more information.
>>>
>>> x=input("plz enter any value :   ")
plz enter any value :   456
>>> type(x)
```

```
<class 'str'>
>>> print(x)
456
>>>
```

Reality of print function in python3

```
>>> print("hii")                ---- >>by default   print("hiii",end="\n")
hii
>>>
>>> print("hii",end='')
hii>>>
```

<u>For any further Studies you can go through:</u>

https://www.python.org/

Python CGI Programming:

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.

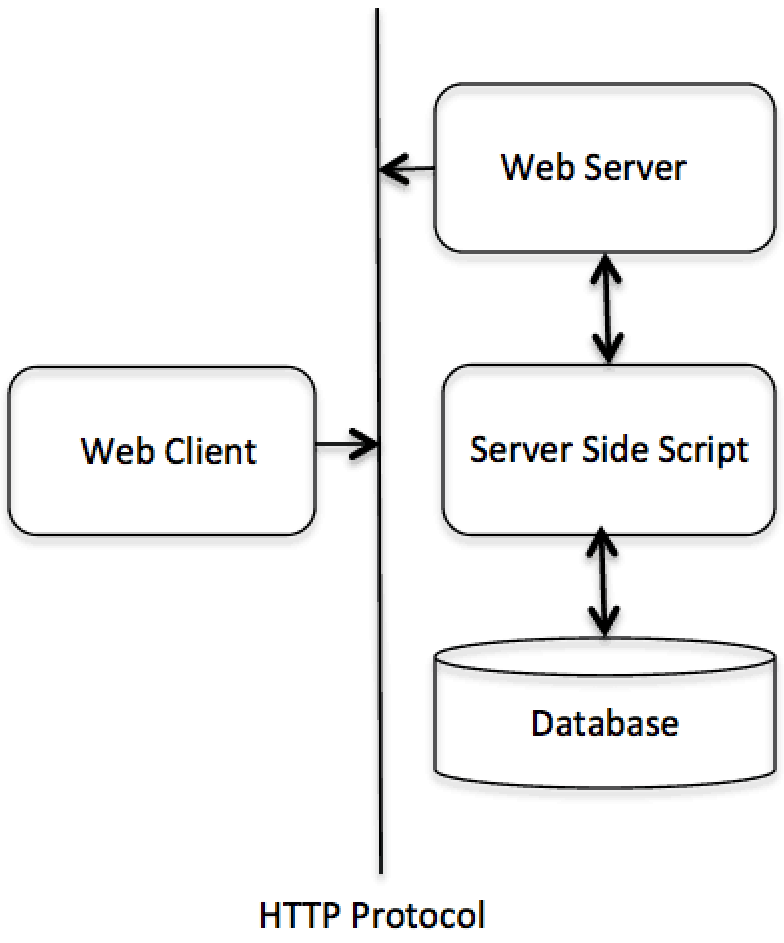
Your browser contacts the HTTP web server and demands for the URL, i.e., filename.

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. If you want to specify any other directory to run your CGI scripts, comment the following lines in the httpd.conf file

```
<Directory "/var/www/cgi-bin">
   AllowOverride None
   Options ExecCGI
   Order allow,deny
   Allow from all
</Directory>
```

```
<Directory "/var/www/cgi-bin">
Options All
</Directory>
```

First CGI Program

Here is a simple link, which is linked to a CGI script called 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 ad.py UNIX command to make file executable

```
root@desktop83 Desktop:   cat   /var/www/cgi-bin/ad.py
#!/usr/bin/python
print "Content-type:text/html"
print  ""
print '<html>'

print '<head>'


print '<title>start programming </title>'

print '</head>'

print '<body>'

print '<h2>CGI started </h2>'

print '</body>'

print '</html>
```

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://192.168.0.83/cgi-bin/hello.py?key1=value1&key2=value2

Simple FORM Example:GET Method

This example passes two values using HTML FORM and submit button. We use same CGI script

This is my html page using form:

root@desktop83 Desktop: cat /var/www/html/index.html

```
<form action="/cgi-bin/hello.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>
```

root@desktop83 Desktop: cat /var/www/cgi-bin/hello.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>"
```

SO this was the basic Idea and Implementation of python CGI programming