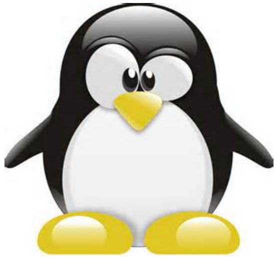
Beaglebone Black I/O

Fang Yuan (yfang@nju.edu.cn)

School of Electronic Science and Engineering
Nanjing University
Nanjing 210046

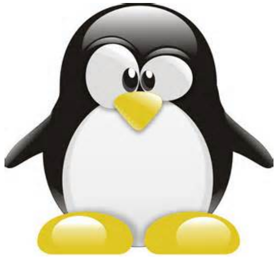


Operating System

An operating system (OS) is system software that manages computer hardware, software resources, and provides common services for computer programs.

The most popular OSes are Windows, Mac OS for desktop personal computer.

Mac OS, iOS, Linux are UNIX-like OSes.

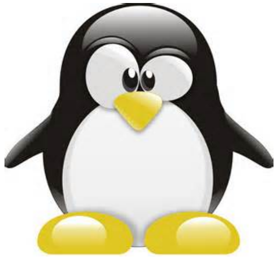


1. Linux

Linux

Linux distributions are dominant in the server and supercomputing fields.

Android (which uses Linux kernel) is most used OS in tablets, smartphones and embedded systems.



1. Linux

Linux

Command Line Interface

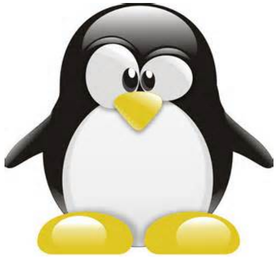
A command-line interface (CLI) processes commands to a computer program in the form of lines of text.

Although most users rely upon graphical user interfaces and menu-driven interactions, CLI is a more powerful interface to skilled users and developers.

```
 prompt  command  [[options] arguments]
```

prompt is a string that indicating the computer is ready to accept input, you don't need to type them. Prompt uses "#" (root) or "$" (normal users), it may also contains pathname and hostname.

Command, options and arguments in command line are case-sensitive



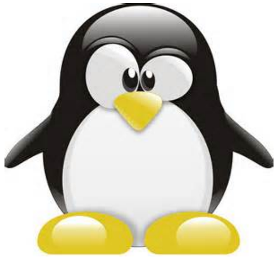
File Attributes

Listing files and directories

```
$ ls -li
drwxr-xr-x 2 user  user     4096 2月    8 11:35 graphics
-rw-r--r-- 2 user  user  1524296 2月    8 12:03 Pithon.pdf
-rwxr-xr-x 1 user  user     5315 2月    8 14:21 hello.py
-rw-r--r-- 2 user  user  1524296 2月    8 12:03 lecture.pdf
drwxr-xr-x 2 user  user     4096 2月    4 16:00 program
drwxr-xr-x 2 user  user     4096 2月    8 13:16 text
```

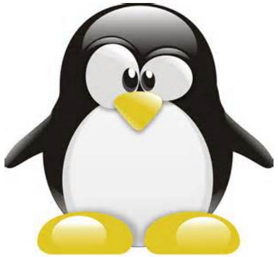
File types, permissions, user and group.

chmod changs permissions, chown changs user and group.



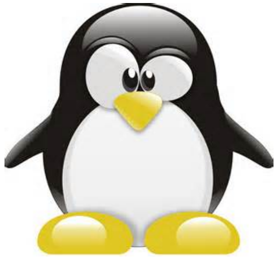
File Operations

- Create a file: Text-editor
- Copy files: cp
- Delete files: rm
- Rename or remove files: mv
- Browse files: more, cat



Directory Operations

- Print current working directory: pwd
- Create directories: mkdir
- Delete am empty directory: rmdir
- Change working directory: cd

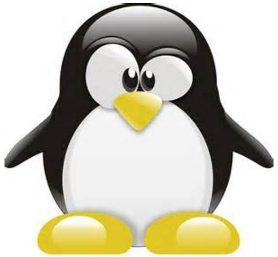


Process

A process is a running program that is scheduled by operating system.

Each process has a unique ID (process ID, or PID) that can be identified by the kernel.

- Watch process status: ps
- Change status of a process: kill, pkill



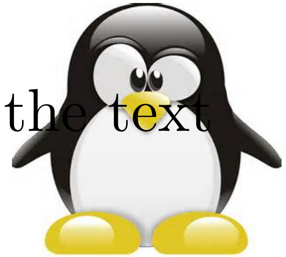
I/O Redirection

Redirection is a form of interprocess communication.

< for input redirection, > for output redirection.

```
$ echo "Hello"
hello
$ echo "print ('Hello')" > file.py
$ more file.py
print ("Hello")
$ python file.py
Hello
```

Command echo prints a line of text. When redirected output, the text is written to a file or other devices.

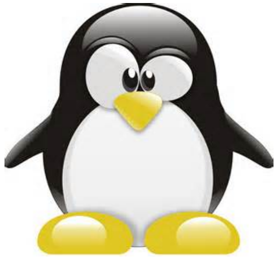


Networking

Each computer in the network (LAN) has a unique address, the IP address. The IP address (IPv4) is a 32-bit integer, and is usually represented in dot-decimal notation, i.e., 192.168.208.123.

Commands that connect remote computer:

- telnet (deprecated, as for security reason)
- ssh (secure shell)
- vncviewer (graphical user interface)

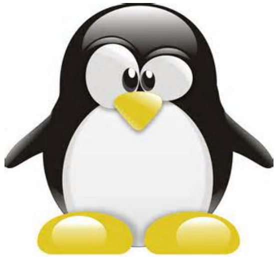


Python as a Programming Language

Python is an interpreted, high-level, general-purpose programming language.

Guido van Rossum, Python's creator

Python supports multiple programming paradigms: procedural, object-oriented, and functional programming.

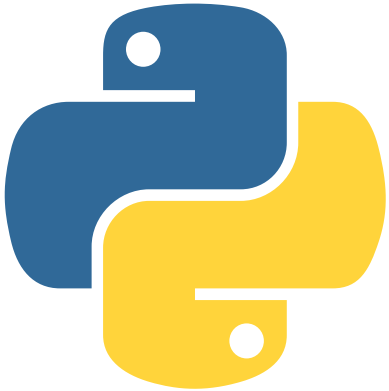


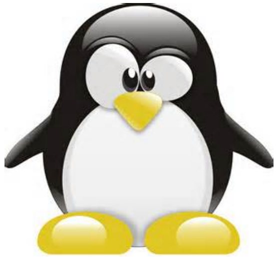
Python is Widely Used

Python interpreters are available for many operating systems.

Many organizations use Python: Wikipedia, Google, Yahoo!, CERN, NASA, Facebook, Amazon, Instagram, Spotify,... . Reddit is written entirely in Python.

Python is a basic library in Linux, and many applications are written in Python.





Running python program

Run python programm in different ways:

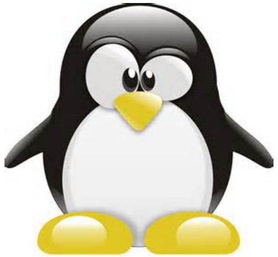
- python in command line

```
$ python3 foo.py
```

- python executables (with interpreter head in foo.py)

```
$ chmod +x foo.py
$ ./foo.py
```

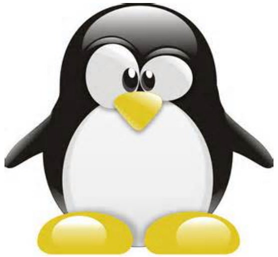
- python environment such as IDLE
- ...



2. Python

Python Shell

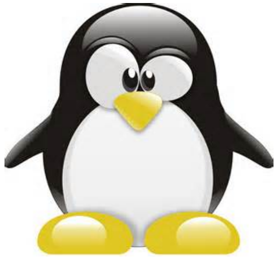
```
# python
Python 3.6.8 (default, Oct  7 2019, 12:59:55)
[GCC 8.3.0] on linux
Type "help", "copyright", "credits" or "license" for more
>>>
```



Python Programming

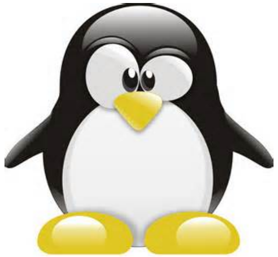
A program is hierachical built from the following levels:

- constants, variables
- expressions: An expression represents a value.
- statements: An instruction that tells the computer to do sth.
- functions: A piece of program, takes some arguments, returns values.
- classes: In object-oriented programming, a class describes an object.
- modules, libraries: A group of of functions organized in a file/library.



A Simple Example

```
#!/usr/bin/env python
# -*- coding: utf-8 -*-
x = 120                       # Assignment
prime = True
for i in range(2, x):         # Loop
    if x % i == 0:            # Indents are significant
        prime = False
        break
if prime is True:             # Conditional
    print ("%d␣is␣a␣prime" % x)
else:
    print ("%d␣is␣not␣a␣prime" % x)
```



Variables

- numerical

  x = 123.456 (float)

  x = False (boolean)

- string

  x = ’Hello’ (string)

  3*x (HelloHelloHello)

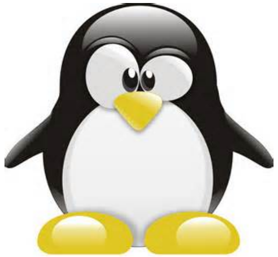
- data structures

  x = [1,2,’Hello’, [3,False]] (list)

  x = (0,) (tuple)

  x = {’name’: ’Zhang3’, ’age’: 28} (dictionary)

index=(begin:boundary:stepsize)

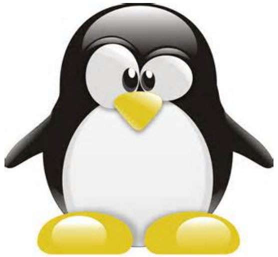


if -- statements

```
if cond:
    statements
```

or

```
if cond:
    statements
elif:
    statements
    ...
else:
    statements
```



Logical operations keyword:

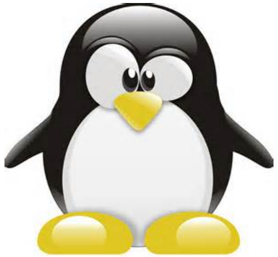
Loops

- for – loop
- while – loop

Loop controls:

- break – end of loop
- continue – jump to next loop
- pass – null function (also used in if – statements)

Block must be indented.



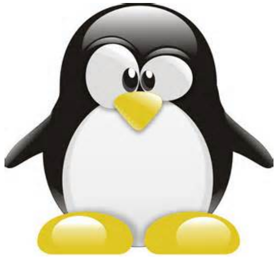
3. Some useful operations

- Conversions: list(), tuple()

  Assignment (ie. a=b) does't create a new list!

- Element related: insert(), remove() (del()), count(),index()

- numerical calculations: max(), min(), sum(), sort()



Dictionary

- Initialize: dict(key=value) or dict(list)

  or direct give items: d = {key: value}

  Dictionary assignment a=b doesn't create a new dict!

- Items related: add, remove (del or pop()), merge

- Keys and items