

Linux 101

2021/11/10



Goal



What



What is Linux

Why



Why Linux

How



How to present your model
with Linux

Course Outline



01

Introduction

What is Linux

03

API Service

Implement a model into
api service

02

Hello Linux

From 0 to give up

04

Startup

Maintain services in
Linux

01

Introduction

What is Linux





1969

year the beginning of everything



What is Linux?

Linux?

Unix?



Linux

UNIX®

Linux???



Debian



CentOS



redhat
Linux



ubuntu



Fedora



Arch

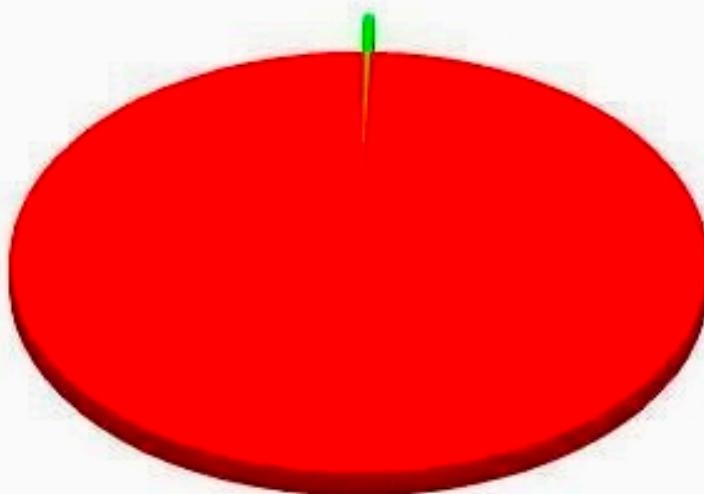


BY OFFENSIVE SECURITY



Mint

Linux programmer's agenda



Program in Linux



Convince the people
to use Linux instead
of Windows, and to
use Open Code
programs.

02

Hello Linux

From 0 to give up



Using Linux for the
first time:



After mastering Linux :



Unlimited power!

Using Windows for the
first time:

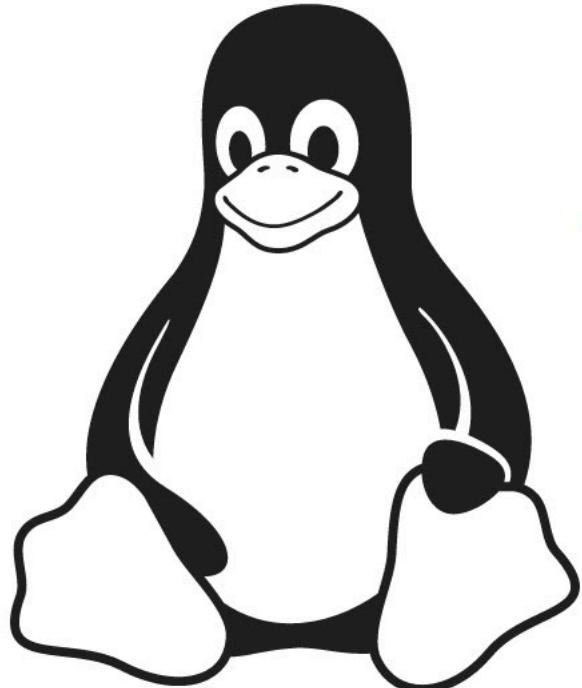


After mastering
Windows :



Linux file system

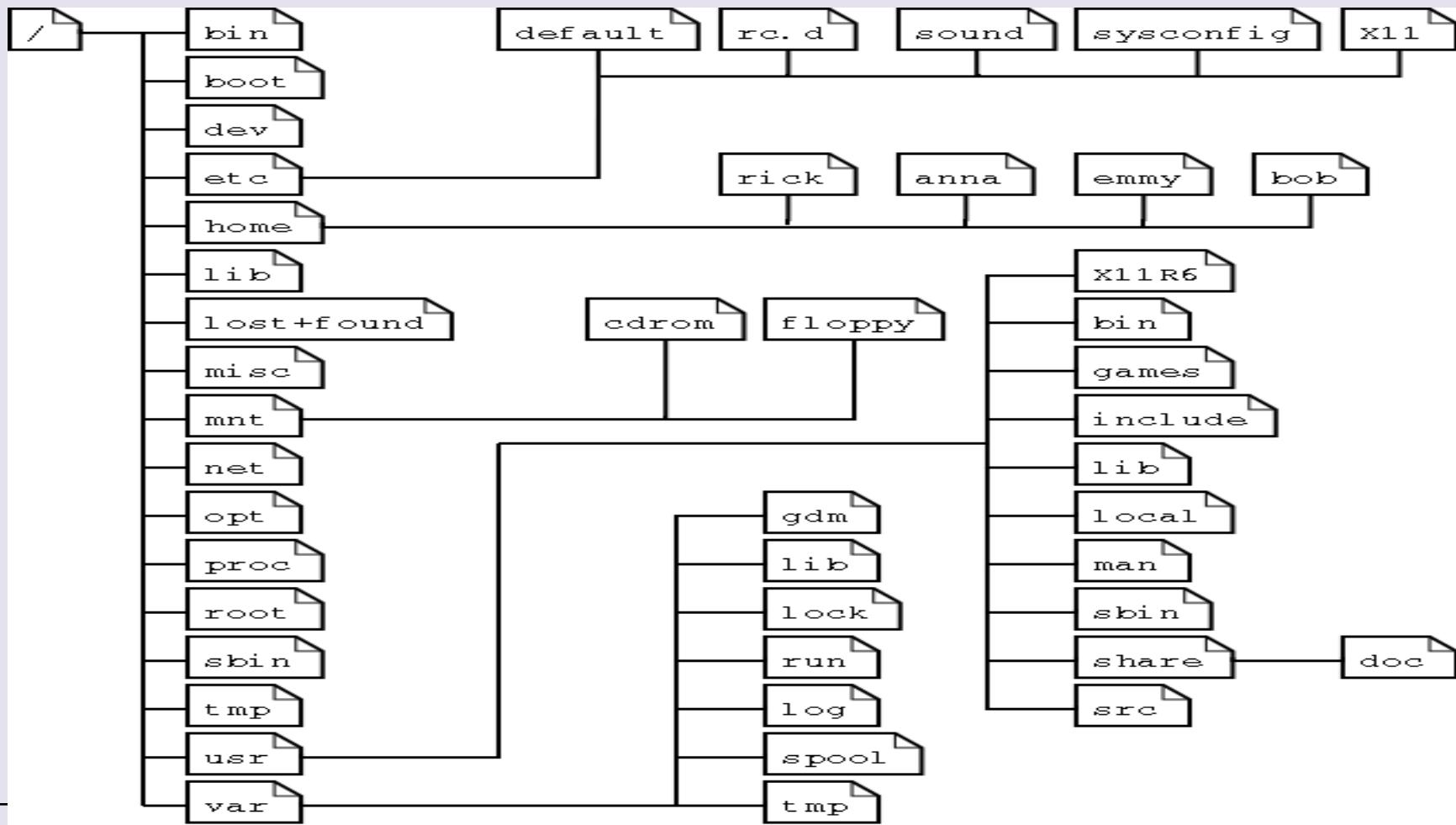




Everything...
is a file.



PROJECT TWINE



Basic folders(1/2)

folders	Meaning
/bin	常用的執行檔存放處
/boot	Linux core, 開機相關檔案
/dev	跟裝置有關的檔案
/etc	系統服務的設定檔
/home	User's home directory
/lib	library
/mnt	軟碟跟光碟掛點的地方
/proc	System core, process info

Basic folders(2/2)

folders	Meaning
/root	Superuser home directory
/sbin	System management program
/tmp	暫放檔案的地方
/usr	系統資訊、程式、指令等等 /usr/local: 預設未來安裝套件目錄
/var	預設工作目錄，主要存放系統資訊檔案或是log等等

File's attribute

```
> ls -l
total 16
-rw-r--r--  1 tungchun  staff   18 Nov  7 15:55 text1
-rw-r--r--  1 tungchun  staff   12 Nov  7 15:58 text2
dr-xr-xr-x  4 root      wheel  4.7K Oct 14 22:10 dev
lrwxr-xr-x@ 1 root      wheel  11B Jan  1 2020 etc -> private/etc
檔案屬性 檔案數 擁有者 擁有者群組 大小 建檔日期 檔名
```

[-] [rw-] [r--] [r--]

0 123 456 789

0: directort/file

123: 擁有人的權限

r: read

456: 同群組使用者權限

w: write

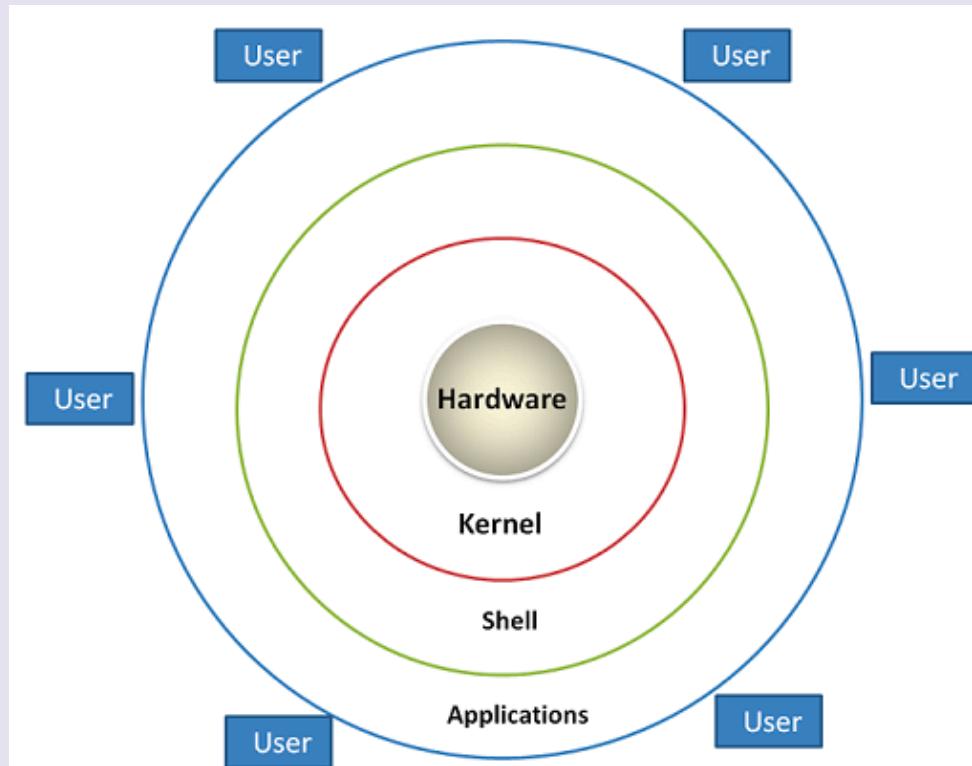
789: 其他使用者權限

x: execute

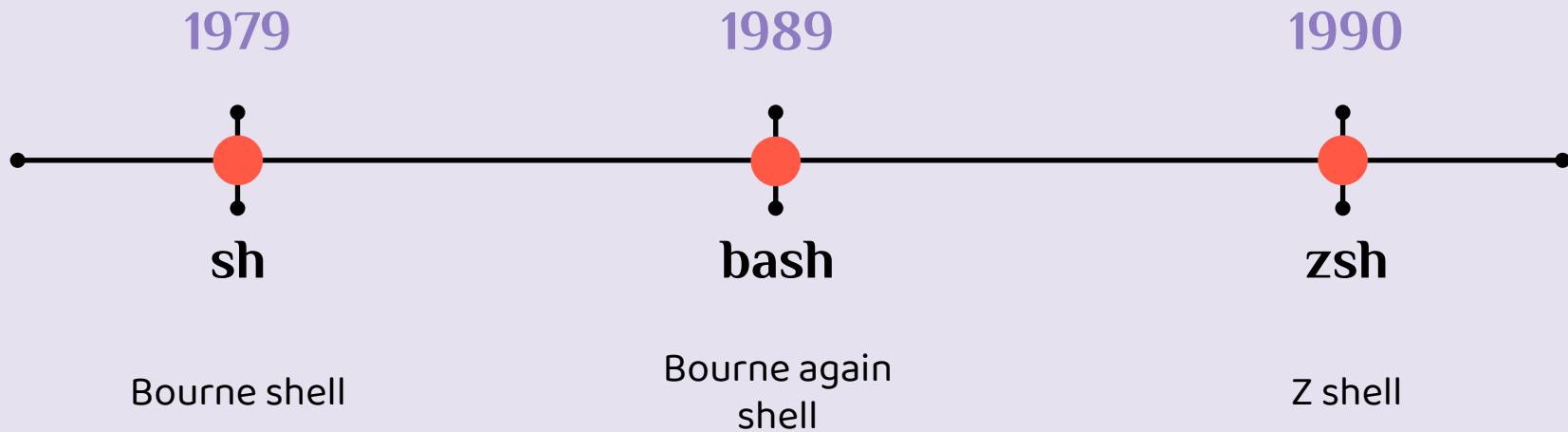
Linux basic command



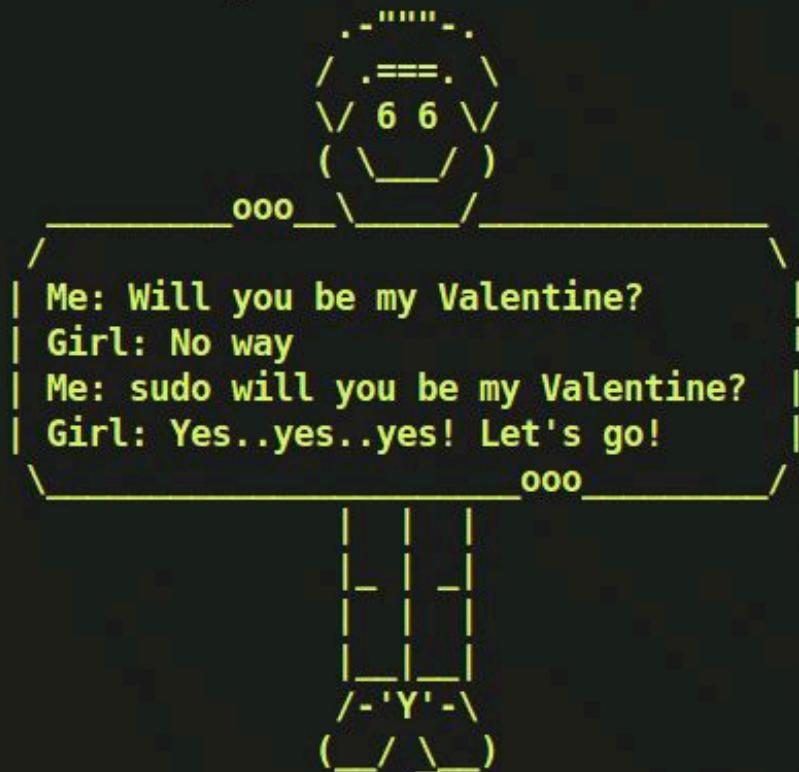
Linux System Architecture



sh? bash? zsh?



Only For Linux Lovers



Superuser/root

```
sh-3.2$ whoami  
tungchun  
sh-3.2$
```



```
> sudo su  
sh-3.2# whoami  
root  
sh-3.2#
```

file management(1/2)

command	Meaning
cat	印出檔案內容
more/less	慢慢看檔案內容
mkdir	建立目錄
rm	移除檔案
mv	移動檔案/目錄
cp	複製檔案/目錄
find	尋找檔案
whereis	尋找檔案

file management(2/2)

command	Meaning
chmod	變更檔案屬性
chown	變更檔案擁有者
chgrp	變更檔案擁有者群組
df	顯示硬碟空間資訊
du	檔案使用掉的空間

echo

```
> echo hello  
hello
```

```
> echo hello      world  
hello world
```

```
> echo "hello      world"  
hello      world
```

```
> echo hello world #123  
hello world
```

```
> echo "hello world #123"  
hello world #123
```

```
> echo $SHELL $HOME $PWD  
/bin/zsh /Users/tungchun /Users/tungchun
```

```
> (exit 0);echo $?;(exit 4);echo $?  
0  
4
```

Text streams and filters

```
> echo "apple\npear\nbanana" | sort  
apple  
banana  
pear
```

```
> echo "apple\npear\nbanana"  
apple  
pear  
banana
```

```
> echo "apple\npear\nbanana" | grep x  
> echo "apple\npear\nbanana" | grep pear  
pear  
> echo "apple\npear\nbanana" | grep pear\n
```

cat

```
> echo "apple\npear\nbanana" > text1
```

```
> cat text1
```

```
apple  
pear  
banana
```

```
> cat > text2
```

```
hello  
world
```

```
> cat text*
```

```
apple  
pear  
banana  
hello  
world
```

```
> cat text* | grep world  
world
```

cut

```
> echo "apple pear banana" | cut -d ' ' -f 1  
apple
```

```
> echo "apple pear banana" | cut -d ' ' -f 1-2  
apple pear
```

```
> echo "apple pear banana" | cut -d ' ' -f 1-3  
apple pear banana
```

```
> cat text1 | cut -d '\n' -f1  
apple  
pear  
ba
```

sed

```
> echo "apple pear banana" | sed 's/a/A/'  
Apple pear banana
```

```
> echo "apple pear banana" | sed 's/a/A/g'  
Apple peAr bAnAnA
```

```
> cat text1 | sed 's/a/A/g'  
Apple  
peAr  
bAnAnA
```

shutdown

```
> sudo shutdown  
shutdown in two minutes

> sudo shutdown -h now  
shutdown now

> sudo shutdown -r now. #=> also reboot  
reboot now

> sudo shutdown -h 20:30  
shutdown at 20:30

> sudo shutdown -h +10  
shutdown in 10 minutes
```

ps aux

```
> ps aux
USER          PID %CPU %MEM      VSZ   RSS TT STAT STARTED      TIME COMMAND
_tungchun    348  7.2  1.1 410731504 182032 ?? Ss 14Oct21 78:56.33 /System/Library/PrivateFrameworks/S
root         554  4.7  3.9 10898732 651248 ?? S 14Oct21 3:45.93 /System/Applications/Utilities/Termin
root         435  1.6  0.1 409004288 22048 ?? Rs 14Oct21 3:22.94 /usr/libexec/TouchBarServer
_tungchun   25541  1.5  0.2 8933052 36384 s003 S 3:39PM 0:34.16 -zsh
_tungchun   25708  1.4  1.1 449533728 181200 ?? S 3:48PM 2:09.41 /Applications/Visual Studio Code - 
_tungchun   1297  0.8  0.1 410777408 18448 ?? Ss 14Oct21 39:35.59 /System/Library/Frameworks/Virtualiz
_tungchun   25701  0.7  0.3 409684880 54000 ?? S 3:48PM 1:15.11 /Applications/Visual Studio Code - 
_tungchun   575  0.4  5.9 11091208 987696 ?? S 14Oct21 8:26.50 /Applications/LINE.app/Contents/MacOS/L
_tungchun   25742  0.3  0.2 447170384 35040 ?? S 3:48PM 0:30.98 /Applications/Visual Studio Code - 
root        634  0.3  0.1 409157200 14464 ?? Ss 14Oct21 74:22.66 /usr/libexec/sysmond
_tungchun   871  0.2  0.1 409439856 19296 ?? S 14Oct21 0:21.04 /System/Library/CoreServices/Siri.ap
_tungchun  14923  0.2 13.9 14356908 2332784 ?? S 26Oct21 24:38.96 /Applications/Microsoft PowerPoint.a
_driverkit  23922  0.2  0.0 408554624 3936 ?? Ss 2:18PM 0:52.46 /System/Library/DriverExtensions/com.apple.driver.kext.AMIGA
_tungchun   25768  0.2  0.5 447501408 82864 ?? S 3:48PM 0:20.35 /Applications/Visual Studio Code - 
_tungchun   589  0.2  0.7 410073504 119920 ?? S 14Oct21 14:27.83 /System/Applications/Utilities/Activi
root        11437  0.2  0.0 408526960 6800 ?? Ss 18Oct21 0:58.77 /System/Library/PrivateFrameworks/An
_tungchun  22371  0.1  0.7 10085160 120784 ?? S Fri12AM 0:53.05 /Applications/Docker.app/Contents/MacOS/Docker
root        341  0.1  0.1 408660256 10992 ?? Ss 14Oct21 2:01.63 /usr/libexec/corebrightnessd --laun
_tungchun  25709  0.1  1.1 449502736 182560 ?? S 3:48PM 0:18.78 /Applications/Visual Studio Code - 
_tungchun  27367  0.0  1.3 434961360 220144 ?? S 4:26PM 0:17.40 /Applications/Google Chrome.app/Contents/MacOS/Google Chrome
_tungchun  27361  0.0  0.4 434641344 61136 ?? S 4:25PM 0:00.54 /Applications/Google Chrome.app/Contents/MacOS/Google Chrome
_tungchun  27360  0.0  0.4 434640256 60576 ?? S 4:25PM 0:00.55 /Applications/Google Chrome.app/Contents/MacOS/Google Chrome
_tungchun  27358  0.0  0.4 434641376 60336 ?? S 4:25PM 0:00.54 /Applications/Google Chrome.app/Contents/MacOS/Google Chrome
_tungchun  27245  0.0  0.4 434640352 63216 ?? S 4:19PM 0:00.79 /Applications/Google Chrome.app/Contents/MacOS/Google Chrome
```

> kill 348 #PID

kill process

Standard I/O streams

- ***stdin***

the *standard input stream*, which provides input to commands.

- ***stdout***

the *standard output stream*, which displays output from commands.

- ***stderr***

the *standard error stream*, which displays error output from commands.

exit code

Exit Code Number	Meaning	Example	Comments
1	Catchall for general errors	let "var1 = 1/0"	Miscellaneous errors, such as "divide by zero" and other impermissible operations
2	Misuse of shell builtins (according to Bash documentation)	empty_function() {}	
126	Command invoked cannot execute	/dev/null	Permission problem or command is not an executable
127	"command not found"	illegal_command	Possible problem with \$PATH or a typo
128	Invalid argument to <u>exit</u>	exit 3.14159	exit takes only integer args in the range 0 - 255 (see first footnote)
128+n	Fatal error signal "n"	kill -9 \$PPID of script	\$? returns 137 (128 + 9)
130	Script terminated by Control-C	Ctrl-C	Control-C is fatal error signal 2, (130 = 128 + 2, see above)
255*	Exit status out of range	exit -1	exit takes only integer args in the range 0 - 255

Something else

› date

Mon Nov 8 00:07:38 CST 2021

› cal

November 2021

Su	Mo	Tu	We	Th	Fr	Sa
1	2	3	4	5	6	
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				

Editor



vim

```
1 """
2 5.7
3 Pairwise Swap:
4 Write a program to swap odd and even bits in an integer with as few instructions as
5 possible (e.g., bit 0 and bit 1 are swapped, bit 2 and bit 3 are swapped, and so on).
6 """
7
8 def pairwise_swap(x):
9     print(bin(x))
10    y = 0b10101010
11    z = 0b1010101
12
13    even_bits = x & y
14    odd_bits = x & z
15    print('get even and odd bits')
16    print(f'even_bits: {bin(even_bits)}')
17    print(f'odd_bits: {bin(odd_bits)}\n')
18
19    even_bits >>= 1
20    odd_bits <=> 1
21    print('shift even and odd')
22    print(f'even_bits: {bin(even_bits)}')
23    print(f'odd_bits: {bin(odd_bits)}')
24
25    return (even_bits | odd_bits)
26
27 print(bin(pairwise_swap(23)))
28
~
```



03

API Service

Implement a model into api
service

What is a Web Service?

A Web service is a collection of open protocols and standards which are widely used for exchanging data between systems or applications.

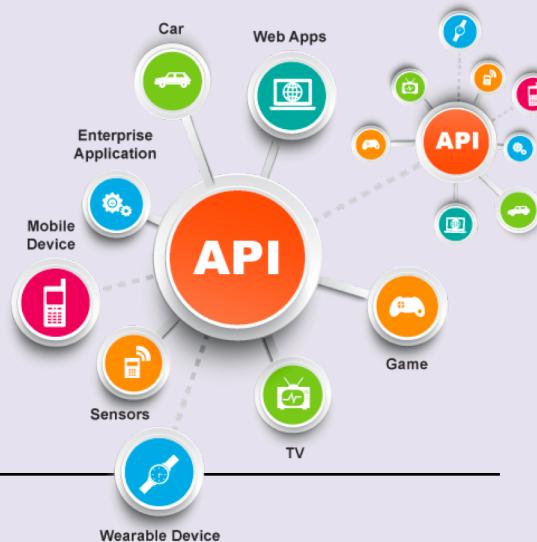
Software applications are written using various programming languages and running on multiple platforms. It allows you to use web services to exchange data over computer networks.



What is an API?

API is the acronym for Application Programming Interface. It is a software interface that allows two applications to interact with each other without any user intervention.

APIs provide products or services to communicate with other products and services without having to know how they're implemented.



Difference between Web and API

Web	API
All web services are APIs.	All APIs are not web services.
It supports XML.	Responses are formatted using Web API's MediaTypeFormatter into XML, JSON, or any other given format.
Need a SOAP protocol to send or receive and data over the network. Therefore it does not have light-weight architecture.	light-weight architecture.
It can be used by any client who understands XML.	It can be used by a client who understands JSON or XML.
Web service uses three styles: REST, SOAP, and XML-RPC for communication.	API can be used for any style of communication.
It provides support only for the HTTP protocol.	It provides support for the HTTP/s protocol: URL Request/Response Headers, etc.

HTTP Method

HTTP method	Description
GET	Retrieve an existing resource.
POST	Create a new resource.
PUT	Update an existing resource.
PATCH	Partially update an existing resource.
DELETE	Delete a resource.

HTTP Status Code(1/2)

Code range	Category
2xx	Successful operation
3xx	Redirection
4xx	Client error
5xx	Server error

HTTP Status Code(2/2)

Code	Meaning
200	OK
201	Created
202	Accepted
204	No Content
400	Bad Request
401	Unauthorized
404	Not Found
415	Unsupported Media Type
422	Unprocessable Entity
500	Internal Server Error

REST Architecture

Representational State Transfer (REST)

- Uniform Interface : 統一介面。
- Stateless : 無狀態。
- Cacheable : 可快取。
- Client-Server : 客戶伺服器分離模式，任何一個客戶端與伺服器都是可替換的。
- Layered System : 分層的系統，客戶端不知道他聯絡的是不是最終伺服器。
- Code on Demand (optional) : 伺服器可以將能力擴充到客戶端。

API Endpoint

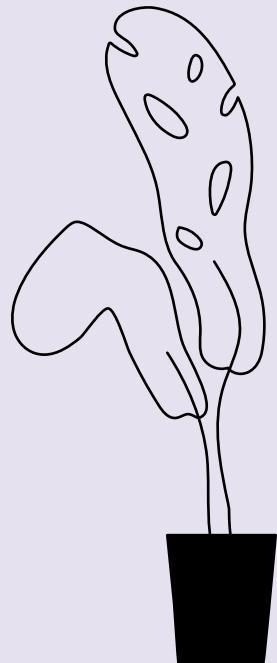
HTTP method	API endpoint	Description
GET	/customers	Get a list of customers.
GET	/customers/<customer_id>	Get a single customer.
POST	/customers	Create a new customer.
PUT	/customers/<customer_id>	Update a customer.
PATCH	/customers/<customer_id>	Partially update a customer.
DELETE	/customers/<customer_id>	Delete a customer.



Practice

https://github.com/dannymonkey/api_service.git

API Service with python





Flask



What is Flask?

- Python 的輕量化 api 框架
- 結合 Werkzeug and Jinja2

Features:

- 內建開發用伺服器和除錯器
- 整合的單元測試支援
- RESTful quest
- 使用Jinja2模板引擎
- 支援安全cookie (客戶端對談)
- 100%的WSGI1.0相容
- 基於Unicode
- 詳細的檔案、教學
- Google App Engine相容
- 可用Extensions增加其他功能



Example

```
from flask import Flask
app = Flask(__name__)

@app.route("/")
def hello():
    return "Hello World!"

if __name__ == "__main__":
    app.run()
```

04

Startup

Maintain services in Linux



How to deploy?

1. Supervisor
2. Docker



Supervisor

Supervisord

supervisord 是 Supervisor 的服務端組件，負責控制子進程的生命週期、響應客戶端組件的命令請求、重啓崩潰的進程以及日誌記錄等工作。

supervisord 使用 Windows-INI 格式的配置文件。

Supervisorctl

是一個藉助命令行進行交互式操作的客戶端組件，它可以通過類似 Shell 的接口訪問 supervisord 提供的功能。

```
[ray@ip-172-31-34-164 supervisord.d]$ sudo supervisorctl update;
[ray@ip-172-31-34-164 supervisord.d]$ sudo supervisorctl status
laravel-worker:laravel-worker_00    RUNNING    pid 2941, uptime 1:06:19
laravel-worker:laravel-worker_01    RUNNING    pid 2942, uptime 1:06:19
laravel-worker:laravel-worker_02    RUNNING    pid 2943, uptime 1:06:19
laravel-worker:laravel-worker_03    RUNNING    pid 2944, uptime 1:06:19
laravel-worker:laravel-worker_04    RUNNING    pid 2945, uptime 1:06:19
laravel-worker:laravel-worker_05    RUNNING    pid 2946, uptime 1:06:19
laravel-worker:laravel-worker_06    RUNNING    pid 2947, uptime 1:06:19
laravel-worker:laravel-worker_07    RUNNING    pid 2948, uptime 1:06:19
[ray@ip-172-31-34-164 supervisord.d]$ █
```

Web Server

如 Supervisor 配置文件中的 [inet_http_server] 項被啓用，則可以通過訪問 <http://localhost:9001> 進入一個功能類似 supervisorctl 的 Web 交互界面。

Supervisor status

Process helloworld-port5000 stopped

[REFRESH](#) [RESTART ALL](#) [STOP ALL](#)

State	Description	Name	Action
running	pid 652, uptime 0:03:09	es/elasticsearch	Restart Stop Clear Log Tail -f
running	pid 651, uptime 0:03:09	es/head	Restart Stop Clear Log Tail -f
running	pid 641, uptime 0:03:09	http	Restart Stop Clear Log Tail -f
stopped	Jun 17 10:09 AM	helloworld-port5000	Start Clear Log Tail -f
running	pid 643, uptime 0:03:09	nginx	Restart Stop Clear Log Tail -f
running	pid 642, uptime 0:03:09	redis	Restart Stop Clear Log Tail -f
running	pid 810, uptime 0:03:05	seafie/seafiehub	Restart Stop Clear Log Tail -f
running	pid 645, uptime 0:03:09	seafie/seafieserver	Restart Stop Clear Log Tail -f

```
pip install supervisor
```

```
cd ~/
```

```
echo_supervisord_conf > supervisord.conf
```

```
### Mac
```

```
mv supervisord.conf /usr/local/etc/
```

```
### Linux
```

```
mv supervisord.conf /etc/
```

```
mkdir ~/supervisor
```

```
mkdir ~/supervisor/log
```

```
mkdir ~/supervisor/conf.d
```

vim /usr/local/etc/supervisord.conf

```
39 [inet_http_server]          ; inet (TCP) server disabled by default
40 port=127.0.0.1:9001         ; ip_address:port specifier, *:port for all iface

169 [include]
170 files = /Users/tungchun/supervisor/conf.d/*.conf
```

Mac

```
supervisord -c /usr/local/etc/supervisord.conf
```

Linux

```
supervisord -c /et/supervisord.conf
```

vim run.sh

```
1 #!/bin/bash
2
3 source /Users/tungchun/FJU_BigData/api_service/venv/bin/activate
4
5 python /Users/tungchun/FJU_BigData/api_service/api/app.py
```

chmod +x run.sh

vim ~/supervisor/conf.d/api.conf

```
1 [program:api_service]
2 command=/Users/tungchun/FJU_BigData/api_service/run.sh
3 autostart=true
4 autorestart=true
5 stderr_logfile=/Users/tungchun/supervisor/log/api.err.log
6 stdout_logfile=/Users/tungchun/supervisor/log/api.out.log
```

supervisorctl

```
supervisor> reread  
api_service: available  
supervisor> status  
supervisor> update  
api_service: added process group  
supervisor> status  
api_service          BACKOFF  Exited too quickly (process log may have details)  


---

supervisor>
```



Docker

docker build -t python-test .

```
apple ~ ~/FJU_BigData/api_service/api ⚡ main ?3
> docker build -t python-test .
[+] Building 3.8s (11/11) FINISHED
  => [internal] load build definition from Dockerfile          0.4s
  => => transferring dockerfile: 37B                          0.0s
  => [internal] load .dockerignore                            0.5s
  => => transferring context: 2B                           0.0s ]
  => [internal] load metadata for docker.io/library/python:3.7-slim   1.3s
  => [internal] load build context                         0.2s
  => => transferring context: 3.63kB                      0.0s
  => [1/6] FROM docker.io/library/python:3.7-slim@sha256:c2cc09c3de140f59b3065b9518fa7beb5fbedb4414762963bfe01079ce219f2e 0.0s
  => CACHED [2/6] WORKDIR /app                            0.0s
  => CACHED [3/6] COPY requirements.txt requirements.txt  0.0s
  => CACHED [4/6] RUN pip3 install --upgrade pip        0.0s
  => CACHED [5/6] RUN pip3 install -r requirements.txt  0.0s
  => [6/6] COPY . .                                     0.5s
  => exporting to image                                 0.8s
  => => exporting layers                             0.5s
  => => writing image sha256:7e9e57f2cc01d5ea63dd94af35a28b74b323ad25c40be90fd19df5cec882e93b 0.0s
  => => naming to docker.io/library/python-test       0.0s ]
```

docker images

```
user@host:~/bigdata/api_service/api> docker images
```

REPOSITORY	TAG	IMAGE ID	CREATED	SIZE
python-test	latest	9769b38a2173	9 seconds ago	107MB
jupyter/datascience-notebook	latest	ba99ca4164f2	13 days ago	4.1GB
postgres	latest	01b2dbb34042	2 weeks ago	354MB
gcr.io/if-aicompetition/task_generator	v1	97dda1331e52	8 months ago	323MB
gcr.io/if-aicompetition/task_generator	<none>	907b687b3cb1	8 months ago	323MB
gcr.io/if-aicompetition/task_generator	<none>	4d9711dc3c09	8 months ago	323MB
spotify/kafka	latest	a9e0a5b8b15e	4 years ago	443MB

docker network ls

```
apple ✚ ~ /FJU_BigData/api_service/api 🐳 ⚒ main ?2
[> docker network ls
NETWORK ID      NAME            DRIVER    SCOPE
6fac7b854fe3    bridge          bridge    local
4d40f0d0abd1    desktop_default bridge    local
18315fa69a63    host            host      local
dfb855a6aabb    none            null      local
```

```
docker run --net=desktop_default -p 5001:5001 -d python-test
```

```
apple:~/FJU_BigData/api_service/api$ main ?3
> docker run --net=desktop_default -p 5001:5001 python-test
* Serving Flask app 'app' (lazy loading)
* Environment: production
  WARNING: This is a development server. Do not use it in a production deployment.
  Use a production WSGI server instead.
* Debug mode: on
* Running on all addresses.
  WARNING: This is a development server. Do not use it in a production deployment.
* Running on http://172.23.0.5:5001/ (Press CTRL+C to quit)
* Restarting with stat
* Debugger is active!
* Debugger PIN: 139-709-387
172.23.0.1 -- [14/Nov/2021 16:28:34] "POST /inference HTTP/1.1" 200 -
172.23.0.1 -- [14/Nov/2021 16:29:41] "POST /user_info HTTP/1.1" 200 -
```

docker ps

main ?2					x 255	1m 33s	23:21:00
CONTAINER ID	IMAGE	COMMAND	CREATED	STATUS	PORTS		
f7e483b29019	python-test	"python3 app.py --po..." sad_lumiere	About a minute ago	Up About a minute	0.0.0.0:5001->5001/tcp		
7a41789ed006	jupyter/datascience-notebook .0.0.0:8000->8000/tcp, 0.0.0.0:8888->8888/tcp	"tini -g -- bash -c ..." desktop_jupyter_1	16 minutes ago	Up 16 minutes	0.0.0.0:5000->5000/tcp, 0		
8b637302a64a	postgres:12	"docker-entrypoint.s..." db	16 minutes ago	Up 16 minutes	0.0.0.0:5432->5432/tcp		
45e13329ed9e	spotify/kafka .0.0.0:9092->9092/tcp	"supervisord -n" desktop_kafka_1	16 minutes ago	Up 16 minutes	0.0.0.0:2181->2181/tcp, 0		

docker help

```
MacBook-Pro:~ supervisor$ docker help
* bits @ 21:58

Usage: docker [OPTIONS] COMMAND
A self-sufficient runtime for containers

Options:
  --config string      Location of client config files (default "/Users/tungchun/.docker")
  -c, --context string Name of the context to use to connect to the daemon (overrides DOCKER_HOST env var and default context
                        set with "docker context use")
  -D, --debug          Enable debug mode
  -H, --host list      Daemon socket(s) to connect to
  -l, --log-level string Set the logging level ("debug"|"info"|"warn"|"error"|"fatal") (default "info")
    --tls              Use TLS; implied by --tlsverify
    --tlscacert string Trust certs signed only by this CA (default "/Users/tungchun/.docker/ca.pem")
    --tlscert string   Path to TLS certificate file (default "/Users/tungchun/.docker/cert.pem")
    --tlskey string    Path to TLS key file (default "/Users/tungchun/.docker/key.pem")
    --tlsverify        Use TLS and verify the remote
  -v, --version         Print version information and quit

Management Commands:
  app*      Docker App (Docker Inc., v0.9.1-beta3)
  builder   Manage builds
  buildx*   Build with BuildKit (Docker Inc., v0.5.1-docker)
  config    Manage Docker configs
  container Manage containers
  context   Manage contexts
  image     Manage images
  manifest  Manage Docker image manifests and manifest lists
  network   Manage networks
  node      Manage Swarm nodes
  plugin    Manage plugins
  scan*     Docker Scan (Docker Inc., v0.5.0)
  secret    Manage Docker secrets
  service   Manage services
  stack     Manage Docker stacks
```

Our conclusions

What

Now you know what is Linux

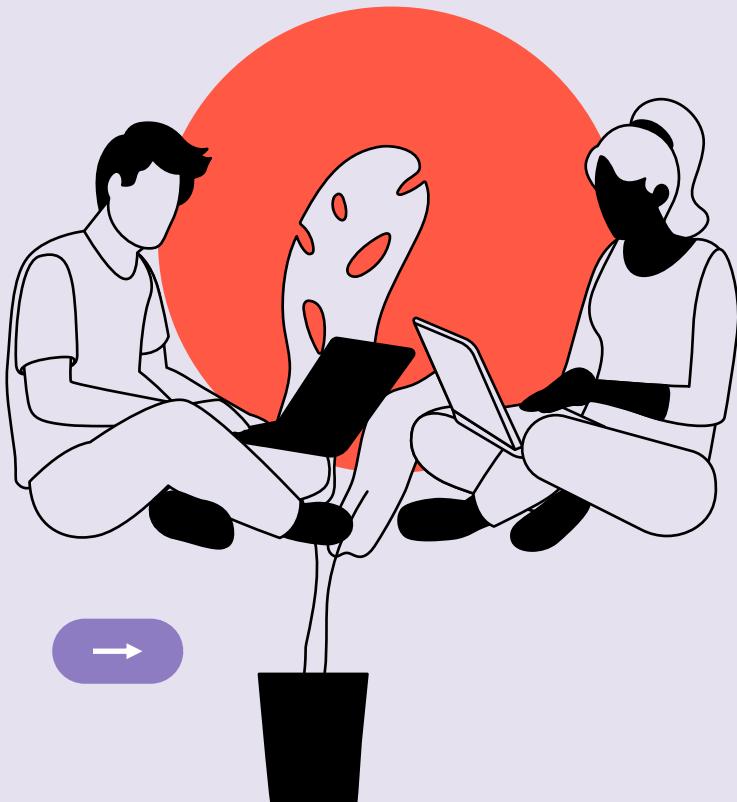
Why

Maybe yes, maybe not

How

You can build your own services





Thanks!

Do you have any questions?

Do feel free to contact me~
Email: danny07292000@gmail.com

