

## 一、測試建置環境

- Distro : [KDE Neon 5.26](#) based on [Ubuntu 20.04](#)
- Toolchain : [GNU make 4.2.1](#) 、 [g++ 9.4.0](#)
- Shell : [bash 5.0.17](#) with [KDE Konsole](#)

## 二、測試執行擷圖（紅字為解說）

- 執行 make all

```
wilson@wilson:~/OS_HW1_1.0.0$ ls
blake.txt Makefile master.cpp mmv.cpp
wilson@wilson:~/OS_HW1_1.0.0$ make all
```

make 前 ls 只有4個檔案！

```

  CREATING BY
  S1103309

[ info ] Compile progress started...
g++ -Wall -g -O ./master.cpp -o ./master.out
g++ -Wall -g -O ./mmv.cpp -o ./mmv.out
[ info ] Compile progress completed!

[ info ] Listing files in current folder using 'ls'...
blake.txt Makefile master.cpp master.out mmv.cpp mmv.out
```

印出自製的啟動畫面

顯示Compile指令（g++），  
同時印出「目前進度狀態的提示訊息」

再一次 ls，多了兩個.out檔！

- 執行 make test

```
wilson@wilson:~/OS_HW1_1.0.0$ make test
```

```

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[ info ] Test progress started...
[ info ] Show Content of 'blake.txt' using 'cat'...
To see a World in a Grain of Sand
And a Heaven in a Wild Flower,
Hold Infinity in the palm of your hand
And Eternity in an hour.

[ info ] Listing files in current folder using 'ls'...
blake.txt Makefile master.cpp master.out mmv.cpp mmv.out
```

印出自製的啟動畫面

提示：Test開始！

使用 cat 檢視 blake.txt 的內容。

使用 ls 顯示目前資料夾內容。

```
[ info ] Start testing with default output file (happy.tmp)  首先測試沒有傳入參數的版本
-----
[ info ] Executing program 'master.out'

./master.out  從這裡開始執行 master.out，以下為執行進度及狀態的提示訊息。
[ Success ] Parent process is running (#7106)
[ Success ] Child process is created and running (#7107)
[ Process ] Replacing current process image with mmv.out (#7107)
[ Success ] Successfully started mmv.out in process (#7107)
[ log ] No passed-in argv, use default files (#7107)
[ Process ] Trying to open file "./blake.txt" (#7107)
[ Process ] Trying to create file "./happy.tmp" (#7107)
[ Success ] Successfully opened file "./blake.txt" (#7107)
[ Success ] Successfully created file "./happy.tmp" (#7107)
[ log ] Reading file content into buffer (#7107)
[ log ] Adding new a line into buffer (#7107)
[ log ] Writing buffer into file (#7107)
[ Success ] Successfully written data into file "./happy.tmp" (#7107)
[ Close ] Child process closed with exit code 0 (#7107)
[ Close ] Parent process closed (#7106)
-----
[ info ] Exited program 'master.out'
-----

[ info ] Show Content of 'happy.tmp' using 'cat'...
\\ ---- Say Hello to s1103309! ----\\
To see a World in a Grain of Sand
And a Heaven in a Wild Flower,
Hold Infinity in the palm of your hand
And Eternity in an hour.

[ info ] Listing files in current folder using 'ls'...
blake.txt happy.tmp Makefile master.cpp master.out mmv.cpp mmv.out

*****
```

每行 log 清楚標記 (#PID)  
紫色為「父行程PID」、  
其餘藍色為「子行程PID」

從描述中可以看到大部分操作在子行程中完成。

以上 log 讓使用者在 make 時得知執行步驟和錯誤訊息，協助 Debug。

使用 cat 檢視新檔案 happy.tmp 的內容。  
可以看到已經在第一行加上新的內容

使用 ls 顯示目前資料夾內容，  
發現多了 happy.tmp

```
*****

[ info ] Start testing with user-defined output file [Bonus]：再來測試有傳入參數的版本
-----
[ info ] Executing program 'master.out' with argv

./master.out ./blake.txt ./happy2.tmp  從這裡開始執行 master.out，並傳入參數
[ Success ] Parent process is running (#7118)
[ Success ] Child process is created and running (#7119)
[ Process ] Replacing current process image with mmv.out (#7119)
[ Success ] Successfully started mmv.out in process (#7119)
[ log ] Passed-in argv detected, use user-defined path (#7119)
[ Process ] Trying to open file "./blake.txt" (#7119)
[ Process ] Trying to create file "./happy2.tmp" (#7119)
[ Success ] Successfully opened file "./blake.txt" (#7119)
[ Success ] Successfully created file "./happy2.tmp" (#7119)
[ log ] Reading file content into buffer (#7119)
[ log ] Adding new a line into buffer (#7119)
[ log ] Writing buffer into file (#7119)
[ Success ] Successfully written data into file "./happy2.tmp" (#7119)
[ Close ] Child process closed with exit code 0 (#7119)
[ Close ] Parent process closed (#7118)
-----
[ info ] Exited program 'master.out'
-----

[ info ] Show Content of 'happy2.tmp' using 'cat'...
\\ ---- Say Hello to s1103309! ----\\
To see a World in a Grain of Sand
And a Heaven in a Wild Flower,
Hold Infinity in the palm of your hand
And Eternity in an hour.

[ info ] Test progress completed! 提示：Test結束！
```

同樣清楚標記 (#PID)

程式自動判斷是否有參數傳入  
在這個情況下使用傳入的檔案

兩個Process都正常結束

使用 cat 檢視新檔案 happy2.tmp 的內容。  
可以看到已經在第一行加上新的內容



- 執行 make clean

```
wilson@wilson:~/OS_HW1_1.0.0$ make clean
```

```
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```

印出自製的啟動畫面

```
[ info ] Clean progress started... 提示：Clean開始！
```

```
rm -v ./*.tmp ./*.out  
removed './happy.tmp'  
removed './happy2.tmp'  
removed './master.out'  
removed './mmv.out'
```

使用 rm 刪除所有 .tmp / .out 檔。  
(加上 -v 代表 --verbose，會顯示刪掉的過程)  
(\* 在 Bash 中代表可以替換成任何字串)

```
[ info ] Clean progress completed! 提示：Clean結束！
```

### 三、Better Error Handling

- 在此舉幾個可能會發生錯誤的例子：  
當用argv指定開啟的檔案不存在、或是mmv.out不存在時，  
就會印出紅色錯誤 log，清楚知道錯誤步驟，協助Debug。  
達到 Test 的目的，可以讓操作者更快速的修復問題。

```
yzucse@yzucse-1313:~/OS_HW1_1.0.0$ ./master.out ./xxx.txt ./happy3.tmp  
[ Success ] Parent process is running (#27611)  
[ Success ] Child process is created and running (#27612)  
[ Process ] Replacing current process image with mmv.out (#27612)  
[ Success ] Successfully started mmv.out in process (#27612)  
[ log ] Passed-in argv detected, use user-defined path (#27612)  
[ Process ] Trying to open file "./xxx.txt" (#27612)  
[ Process ] Trying to create file "./happy3.tmp" (#27612)  
[ Error ] Failed to open file "./xxx.txt" (#27612)  
[ Error ] Child process shutted down unexpectedly (#27612)  
[ Close ] Parent process closed (#27611)
```

#### ▲ Read 檔案不存在時的錯誤

```
yzucse@yzucse-1313:~/OS_HW1_1.0.0$ ./master.out  
[ Success ] Parent process is running (#27779)  
[ Success ] Child process is created and running (#27780)  
[ Process ] Replacing current process image with mmv.out (#27780)  
[ Error ] Failed to replace process image by exec (#27780)  
[ Error ] Child process shutted down unexpectedly (#27780)  
[ Close ] Parent process closed (#27779)
```

#### ▲ mmv.out 不存在時的錯誤

## 四、其他解說

- **更多解說請見程式碼中的詳細註解。**
- 啟動畫面使用 figlet 套件實做，再pipe到tee套件中最後存入 .signature.txt（隱藏檔），make時用 cat 印出。
- 在cpp檔及Makefile中可以看到許多 [Shell Color Codes](#)，讓 log 的輸出可以有種顏色，更為一目了然狀態。
- Makefile中有許多以「@」開頭的指令，主要用來隱藏不必要顯示的指令 (例如：echo 出 log的指令)，讓畫面更乾淨。

## 五、心得感想

從高二開始接觸與使用Linux，到現在也接近4年。這讓我很喜歡現在的OS課程和作業。以前有寫過一些Bash Script，所以這次作業還算滿順利完成的。

因為系統已經直接裝在硬體上了，省掉了裝虛擬機的時間。所以這次作業花了滿多時間著重在執行過程的輸出，配合各種Bash的顏色，讓make過程中的 log 更為美觀、易讀。