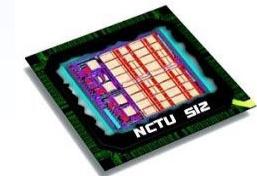


2022 Spring ICLAB

Lecturer: Wen-Yue, Lin

System Integration and Silicon Implementation (Si2) Lab
Institute of Electronics
National Yang Ming Chiao Tung University, Hsinchu, Taiwan
Email: kenlin.ee09@nycu.edu.tw



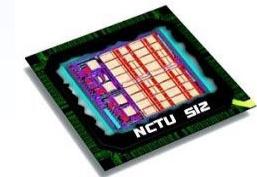
Outline

- ✓ Course Introduction
- ✓ Course Syllabus / Rule / Grade
- ✓ Add / Drop Course Issue
- ✓ Server Introduction -- ED415



Introduction to IC Design Lab

Wen-Yue, Lin



Apple New Chip – M1

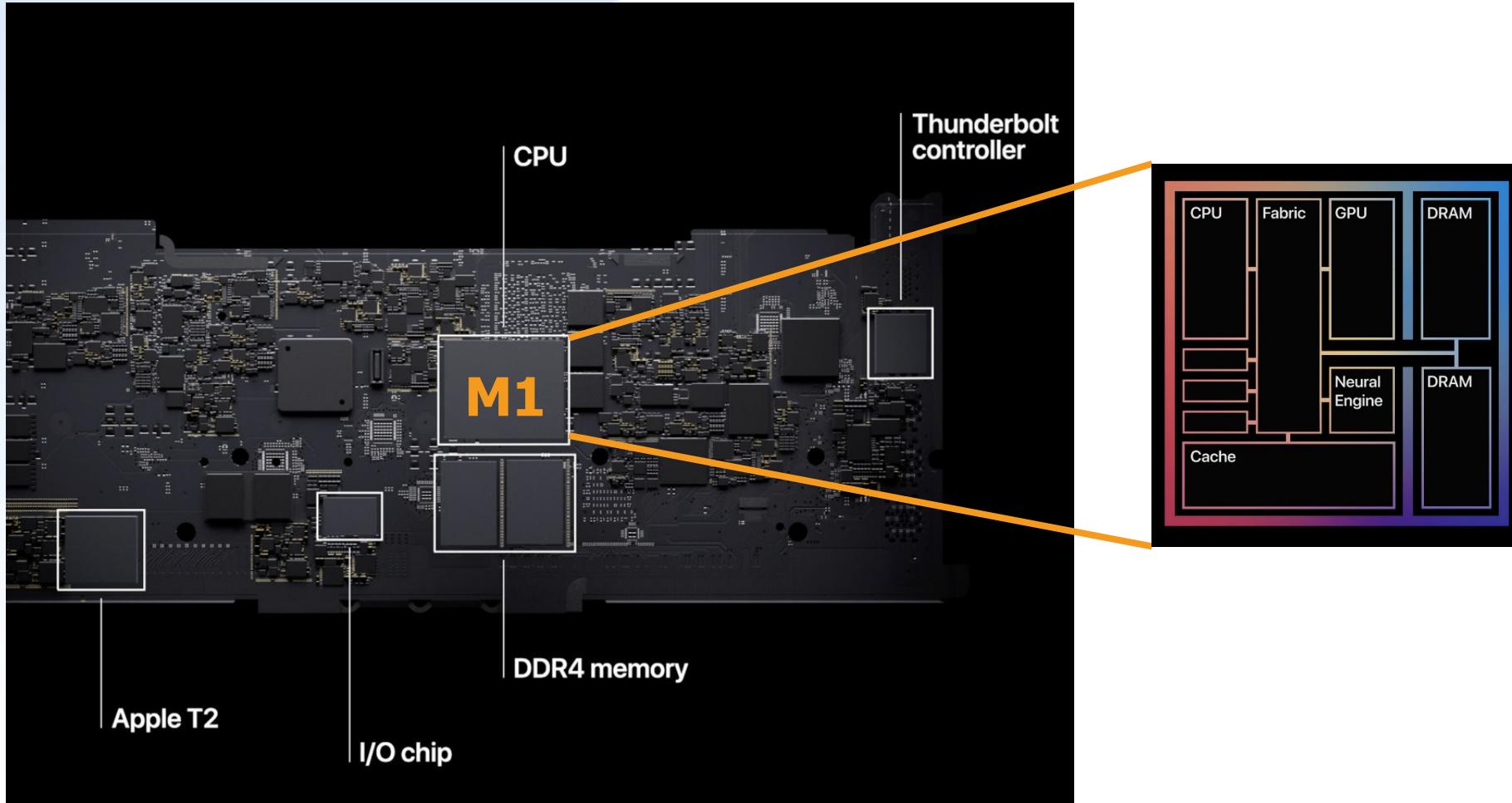


Small chip. Giant leap.

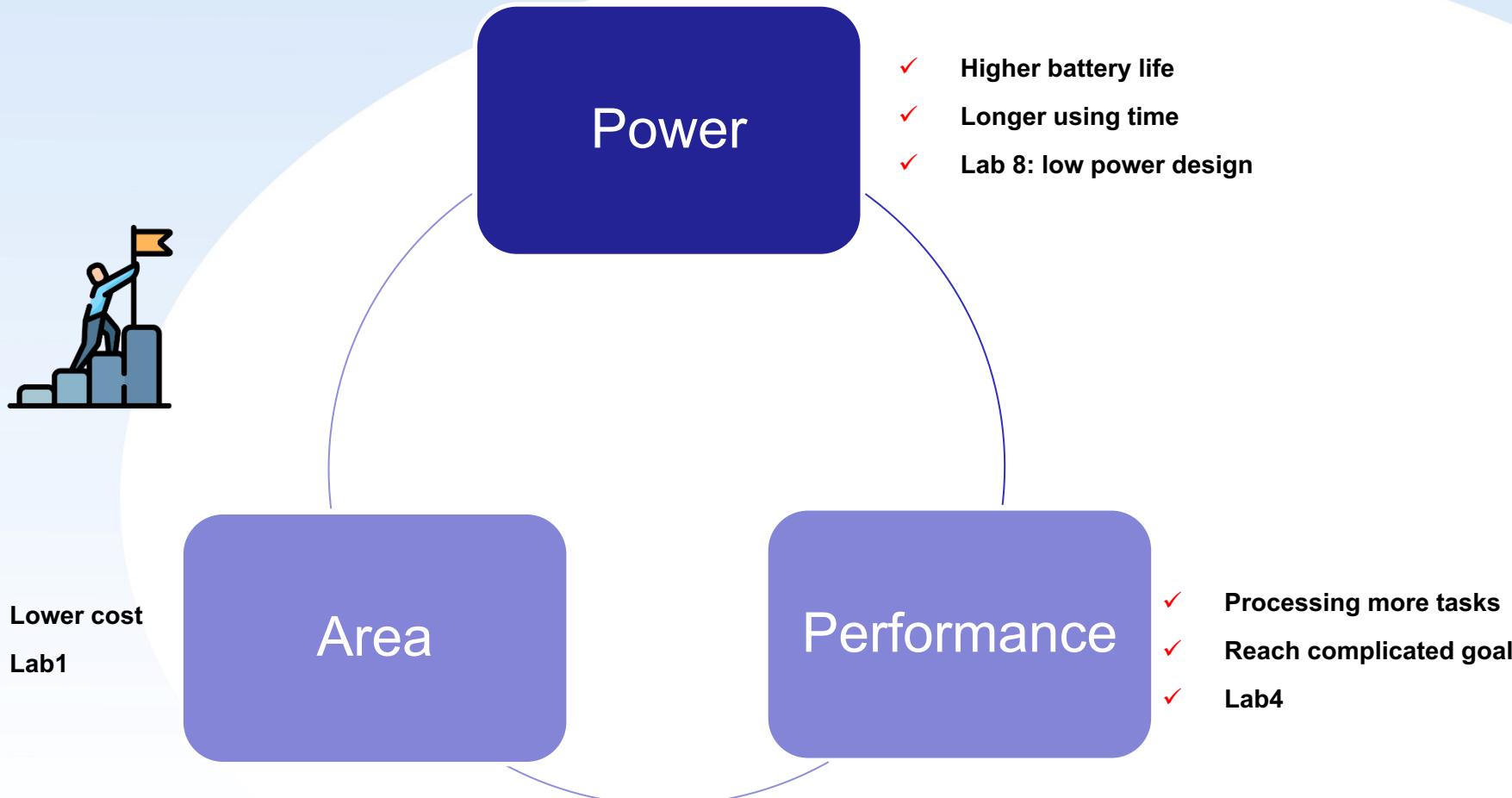


M1, Arm-Based SoC

✓ Integrate several sub-systems (system on a chip)

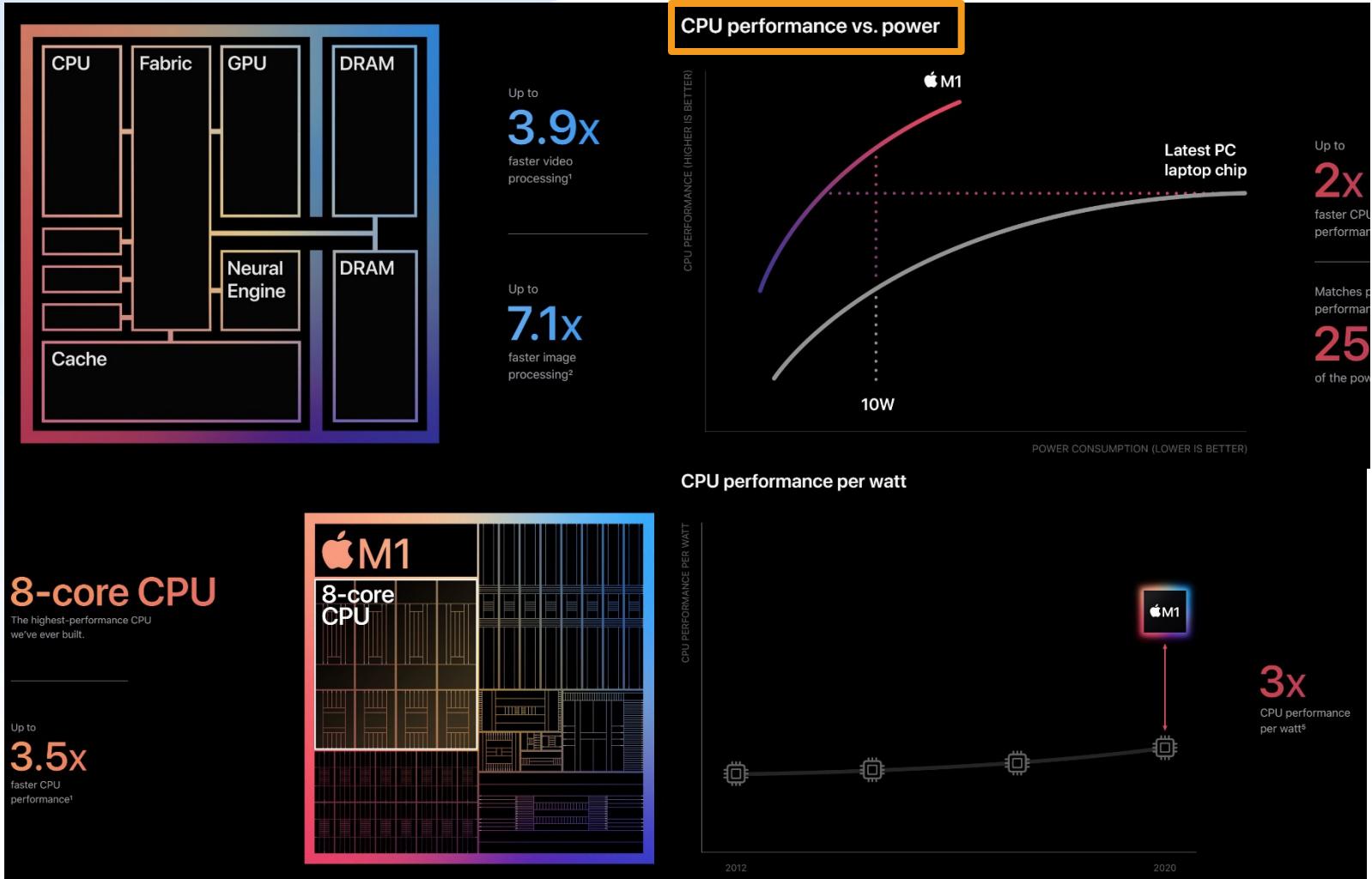


Performance Power Area



What is PPA?

✓ PPA Balance (high Performance, low Power, low Area)

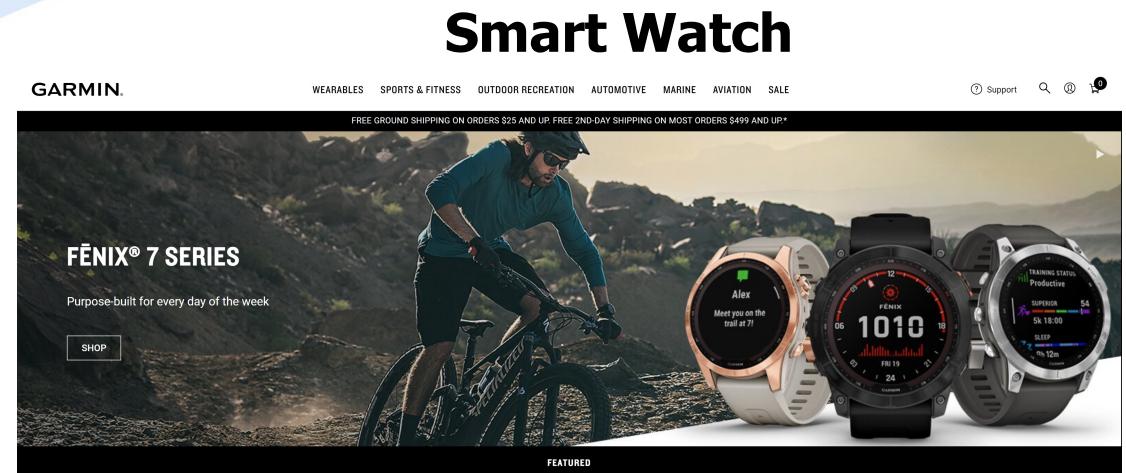


Low Power Application

Power

Performance

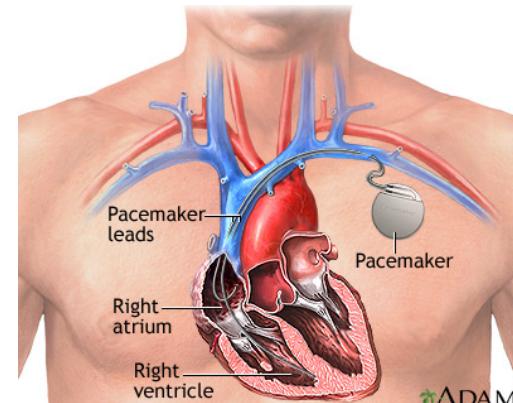
Area



Smart Watch

(Source: Garmin)

Bio Chip



(Source: ADAM)

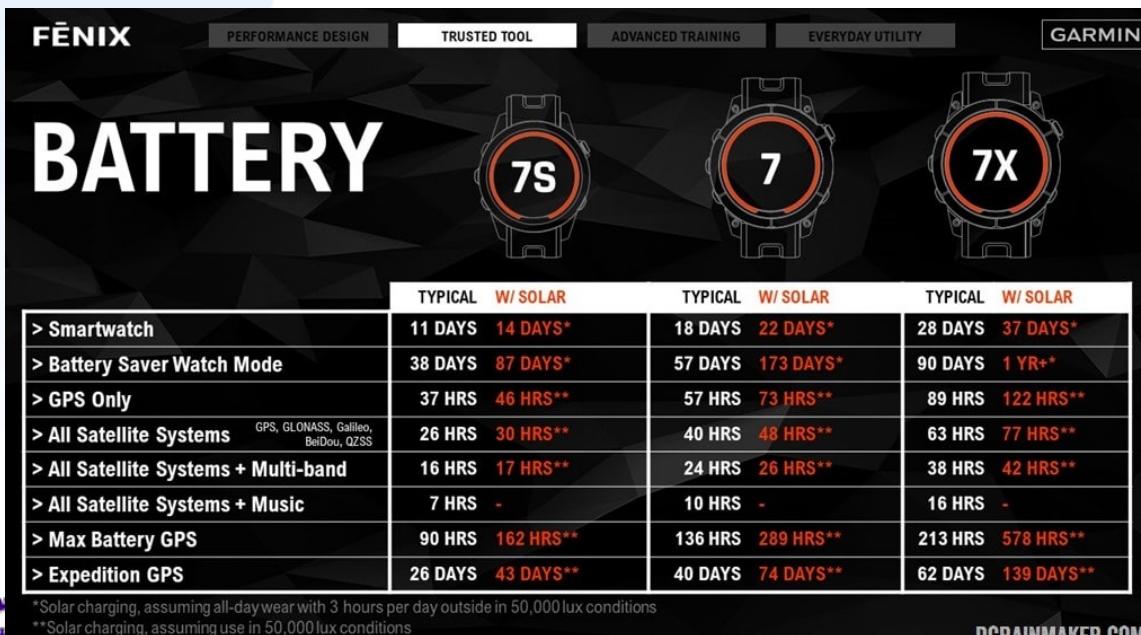


Power Consumption Comparison – Smart Watch



- ✓ **Battery life: about a month VS. 18 hours**
 - Garmin with Solar charging can have infinite battery life
- ✓ **What's the difference?**
 - Application specific IC in Garmin smartwatch VS. General CPU in Apple Watch
 - General CPU: Flexible in app programming
 - Application specific IC: low power consumption

Garmin Fenix 7X Price: \$999



Apple Watch Series 7 Price: \$429



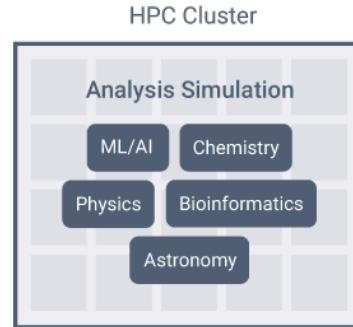
High Performance Application

Power

Performance

Area

HPC



(Source: Gigabyte)



Lower area Application

Power

Performance

Area



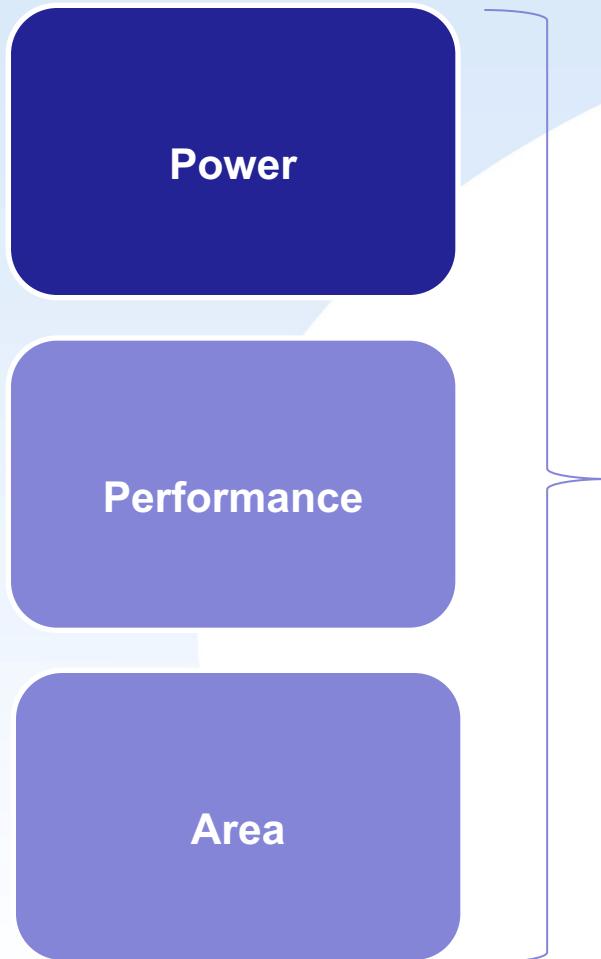
(Source: ENIAC)



(Source: iPad)



PPA balanced Application



Laptop



(Source: Surface)

Mobile



(Source: iPhone)



Grading Policy

Grading Policy

Weekly Lab Exercise x 12	(60%)
Midterm Project	(10%)
Midterm Exam	(8%)
Online Test	(6%)
Final Project	(10%)
Final Exam	(8%)
Bonus (Formal Verification)	(3%)

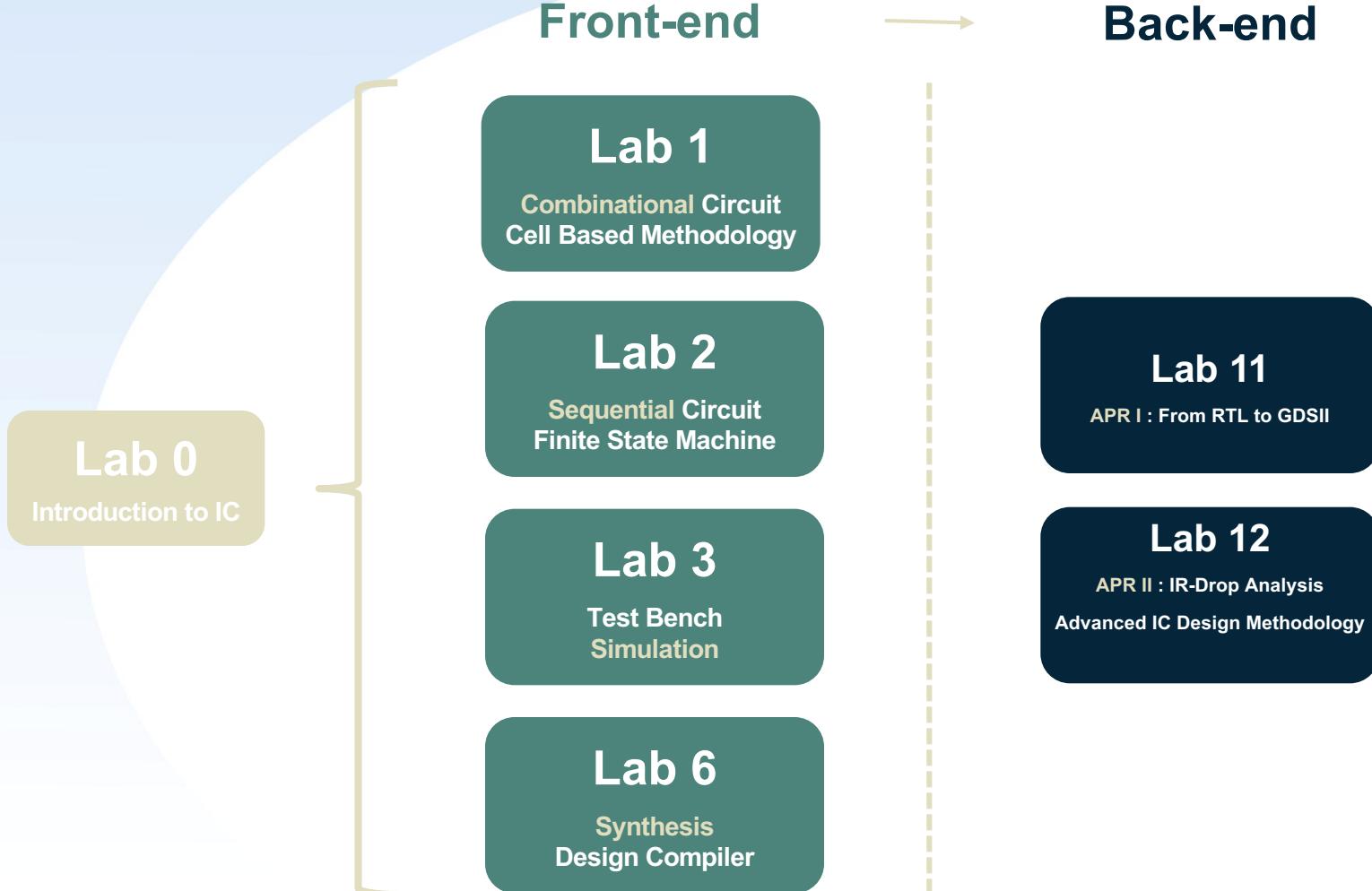


TA List

Name	Email	Lab	Office
Wen-Yue Lin 林文約 (Main TA)	kenlin.ee09@nycu.edu.tw	Lab00, Bonus lab	ED430
Chih-Wei Peng 彭志偉	epeng.ee10@nycu.edu.tw	Lab 09, 10	ED430
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Yu-Wei Lu 盧昱偉	ywlu1015.st10@nycu.edu.tw	Lab 03, 05	ED430
Yu-Lun Hsu 許毓倫	kimi870928.ee06@nctu.edu.tw	Lab 08, 12	ED317A
Hung-Kun Chang 張弘坤	owwwojeff@gmail.com	Lab 07, 11	ED317A



What will we learn in IC Design Lab? (1/2)



What will we learn in IC Design Lab? (2/2)

Timing

Lab 4

Static Time Analysis
Pipeline

Lab 7

Cross Clock Domain
Synthesis STA

Memory / IP

Lab 5

Memory Compiler
SRAM IP

Lab 2&6

Soft IP
Usage & Design

Power

Lab 8

Lower Power Design
Prime Time

System Verilog & Verification

Lab 9

System Verilog
Design

Lab 10

System Verilog
Verification

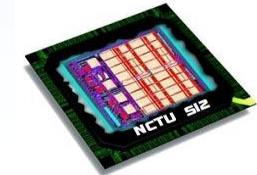
Bonus

System Verilog
Formal Verification



IC Lab Course Rule

Wen-Yue, Lin



Add / Drop Course Issue

- ✓ If you cannot access New E3 material, please finish the google form before 2/17 13:00

<https://forms.gle/chTdV1ALo3BM86mN8>



- ✓ Add / Drop Result Announcement
 - The add / drop result will be announced before 2/18 17:00
 - If you are NYCU student, we can add you online
=> no need to sign paper add / drop form
 - If you aren't NYCU student, please finish administration by yourself
Contact Main TA by email if you have any problem
Email: kenlin.ee09@nycu.edu.tw
- ✓ Same ICLAB course will be held next semester



Sign Documents: NDA & Honor Code

Honor Code

NDA

Please sign the following document either digitally or print out and scan with your signature

Upload it on New E3 before 2/22 12:00 (for those who still can't access New E3, you can access it after add to this course, don't worry)

If anything goes right, you will have **one bonus point** on your final score

NCTU EE ICLab Honor Code

By signing this document, I hereby acknowledge that any form of plagiarism is not allowed in this class. Specifically, for this course, plagiarism includes but not limited to: copying/paraphrasing others' codes or reports partially or completely.

I am fully aware of the following principles:

- (1) Share ideas, not codes/reports.
- (2) Professor & TAs has the very right to ask you explain your codes/reports.
- (3) Not copying codes from the internet.
- (4) Any form of assistance should be declared in the report.
- (5) Don't share class video, content or your code on internet / with others.

I understand that breaking the Honor code will result in:

Failure in this course

Date: _____

Student ID : _____

Signature : _____



Other issue

1. Don't let others know the Webex link (anyone can join if they have the link)
2. Open the mic only if you have anything to say
3. The course will be recorded, but only the first class record will be released
4. don't share class material (video, slides or code) with other

【 TA Time 】

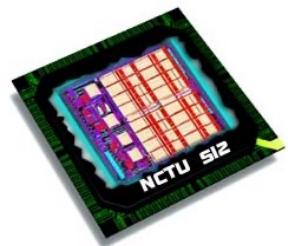
From Lab01 to Lab04, there will be face to face TA time @ED415. Student can ask questions relate to coding style, but TA won't help student to debug

Password for the slides: iloveiclab



Lec00 Environment Setting

Lecturer : Wen-Yue Lin



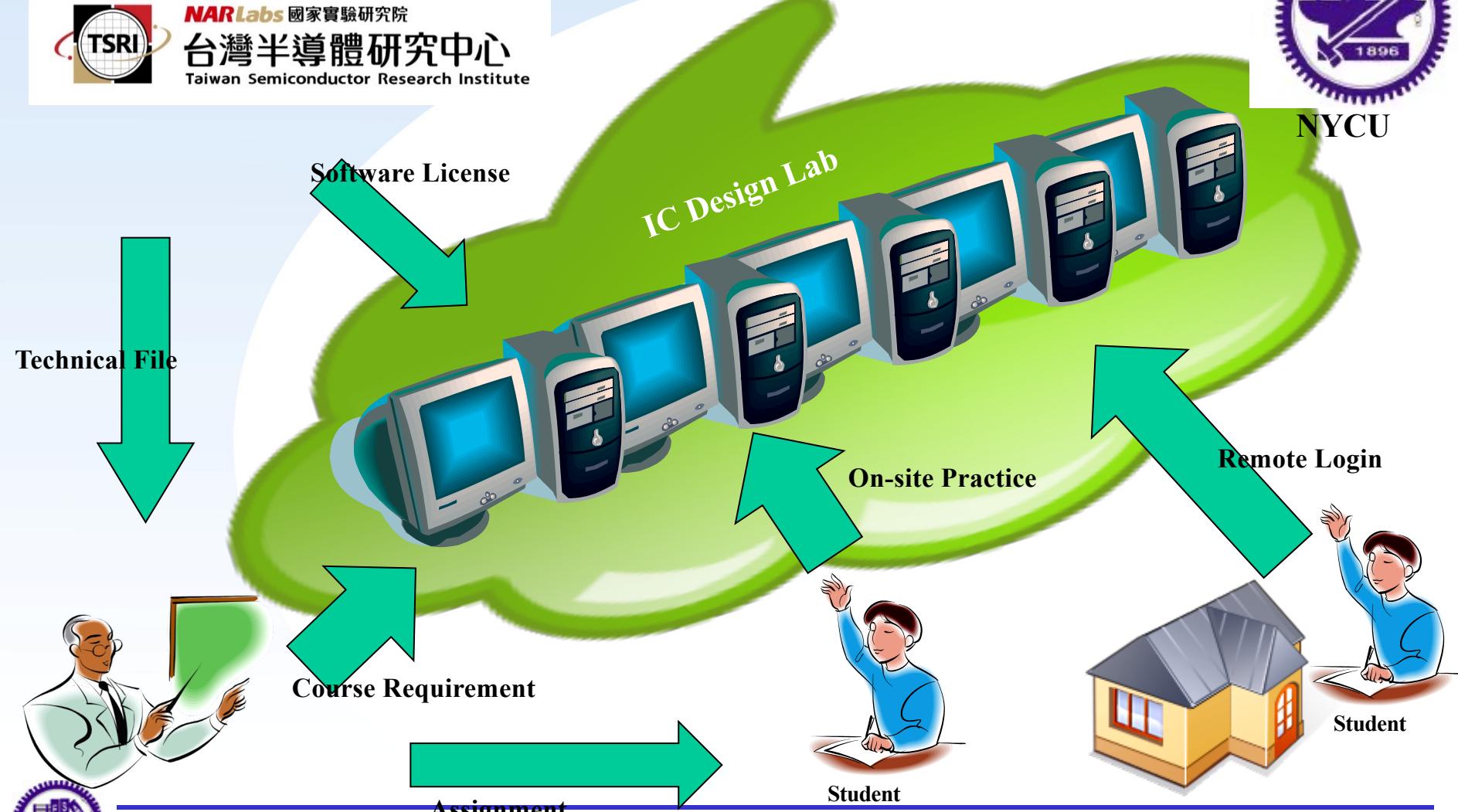
Environment



NARLabs 國家實驗研究院
台灣半導體研究中心
Taiwan Semiconductor Research Institute



NYCU



Assignment

ICLAB NCTU Institute of Electronics

Work Station

✓ Use SSH to connect

- port = 22

✓ ee???.ee.nctu.edu.tw (?? = 01~06)

✓ linux???.ee.nctu.edu.tw (?? = 02~35)

✓ Do not use linux01

✓ Access

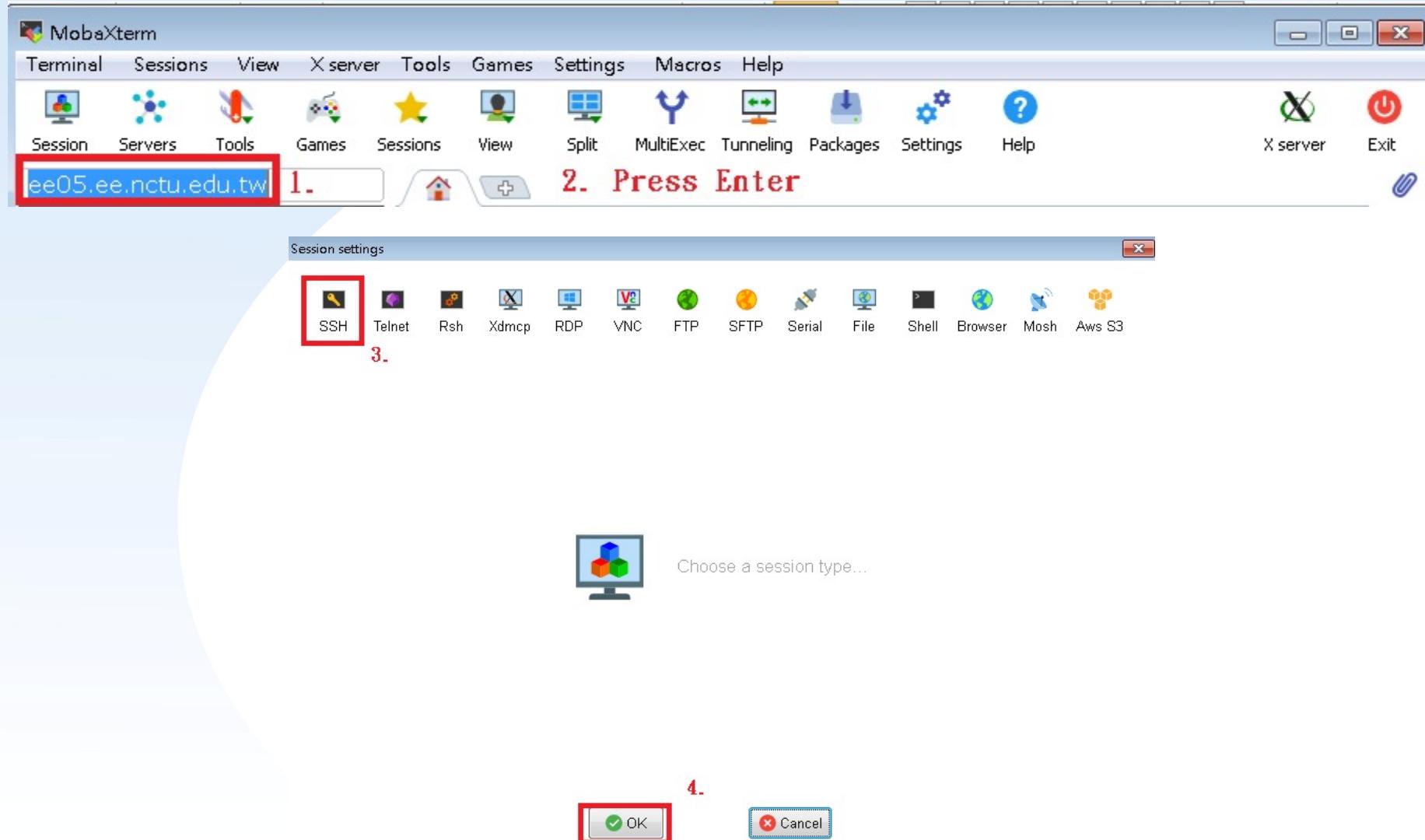
- Mobaxterm (Recommended)

Appendix:

- Putty + X-display software (Xwin-32, Xming) + FTP (Filezilla)
- Sublime

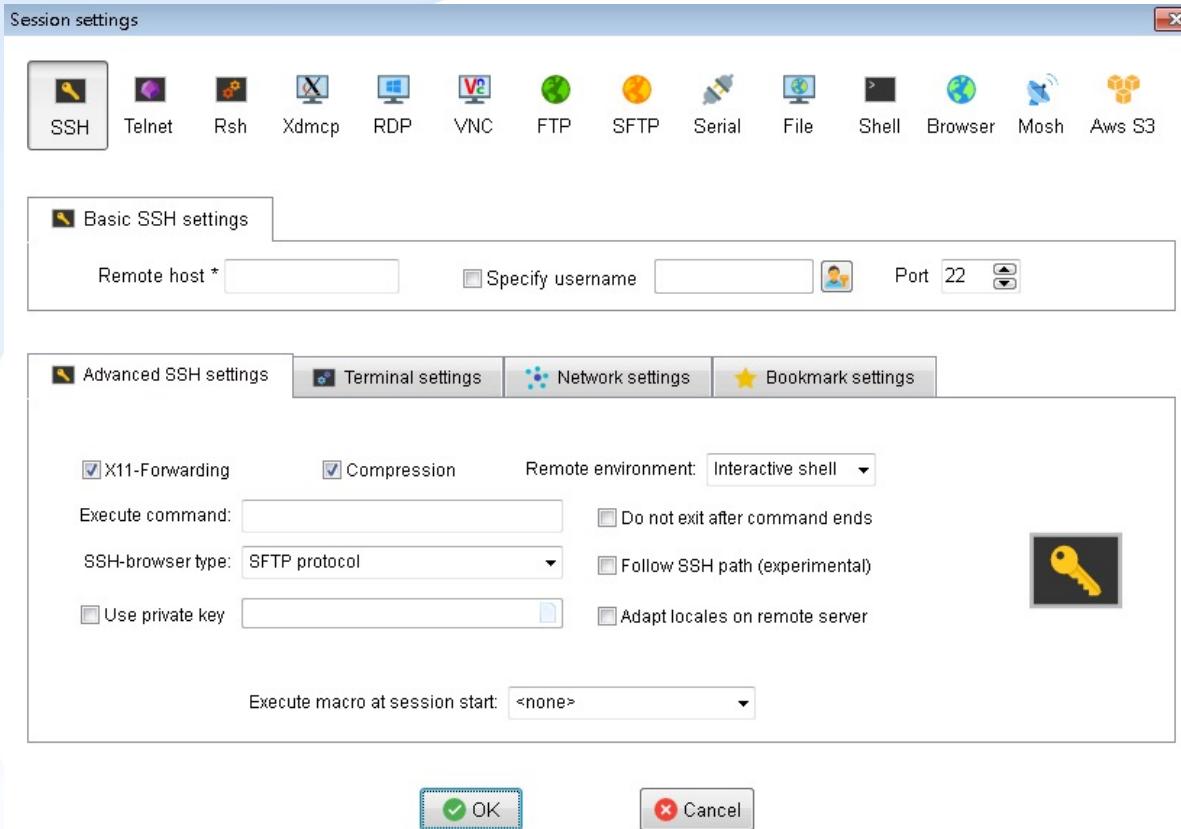


Mobaxterm



Mobaxterm

✓ Default with X11 Forwarding



✓ Embedded sftp system



Linux : Basic Operations

- ✓ **>man COMMAND** //format and display the on-line manual pages
 - ex: man ln
- ✓ **>mkdir DIRECTORY** //make directory
 - e.g. mkdir -p /home/test
- ✓ **>cd DESTINATION** //change current directory
 - e.g. cd ../iclab08/Lab01/
 - e.g. cd (change to home directory)
- ✓ **>cp SOURCE DESTINATION** //copy files
 - e.g. cp ABC.v DEF.v
 - e.g. cp -rf Lab01/ Lab02/
- ✓ **>mv SOURCE DESTINATION** //move or rename files
 - e.g. mv ABC.v ../ABC.v
 - e.g. mv ABC.v DEF.v



Linux : Basic Operations

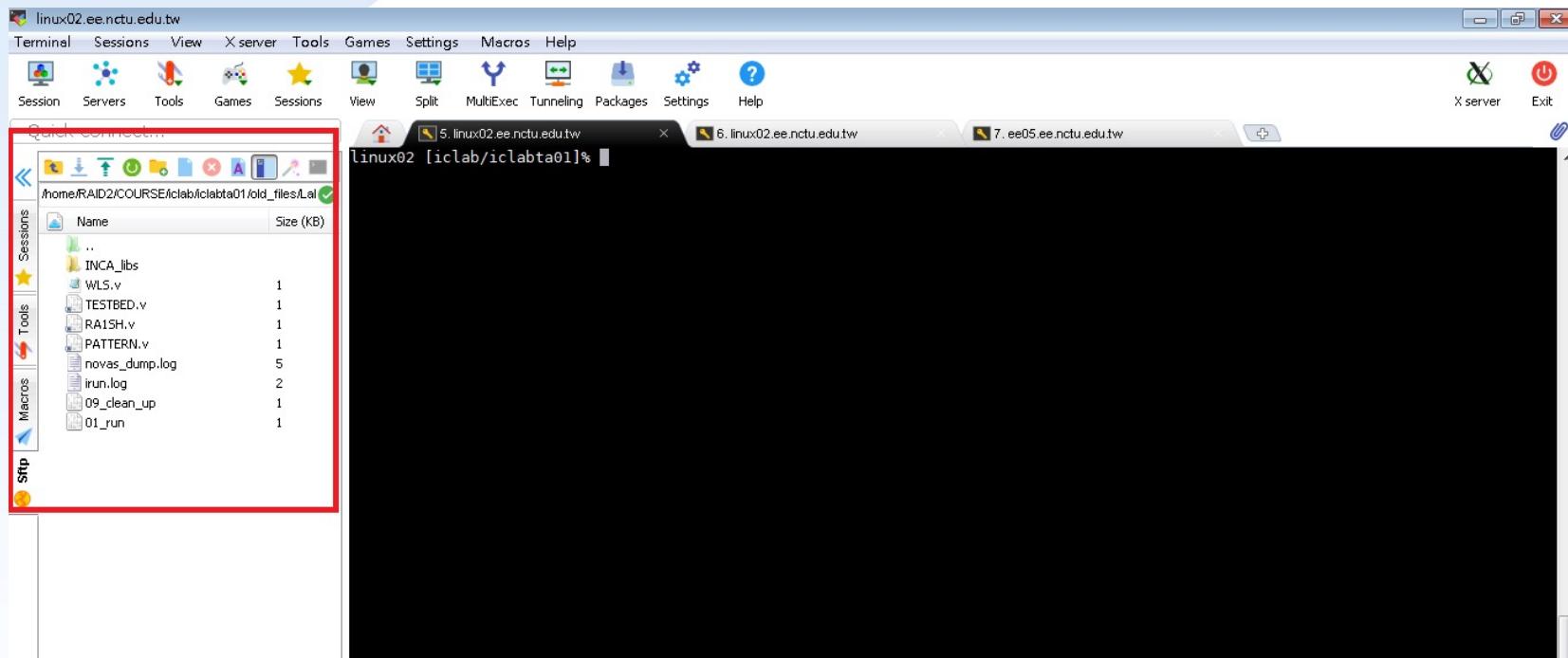
- ✓ **>rm FILE_NAME** //remove (delete) files
 - e.g. rm ABC.v
 - e.g. rm -rf Lab01/
- ✓ **>ls** //list directory contents
 - e.g. ls -l
 - or you can use *dir* as well.
- ✓ **>ln TARGET LINK_NAME** //make links between files
 - e.g. ln -s ~iclabt01/LIB/slow.db slow.db
- ✓ **>quota** //display disk usage and limits
 - e.g. quota



Editor

✓ Download files, use your own editor and re-upload

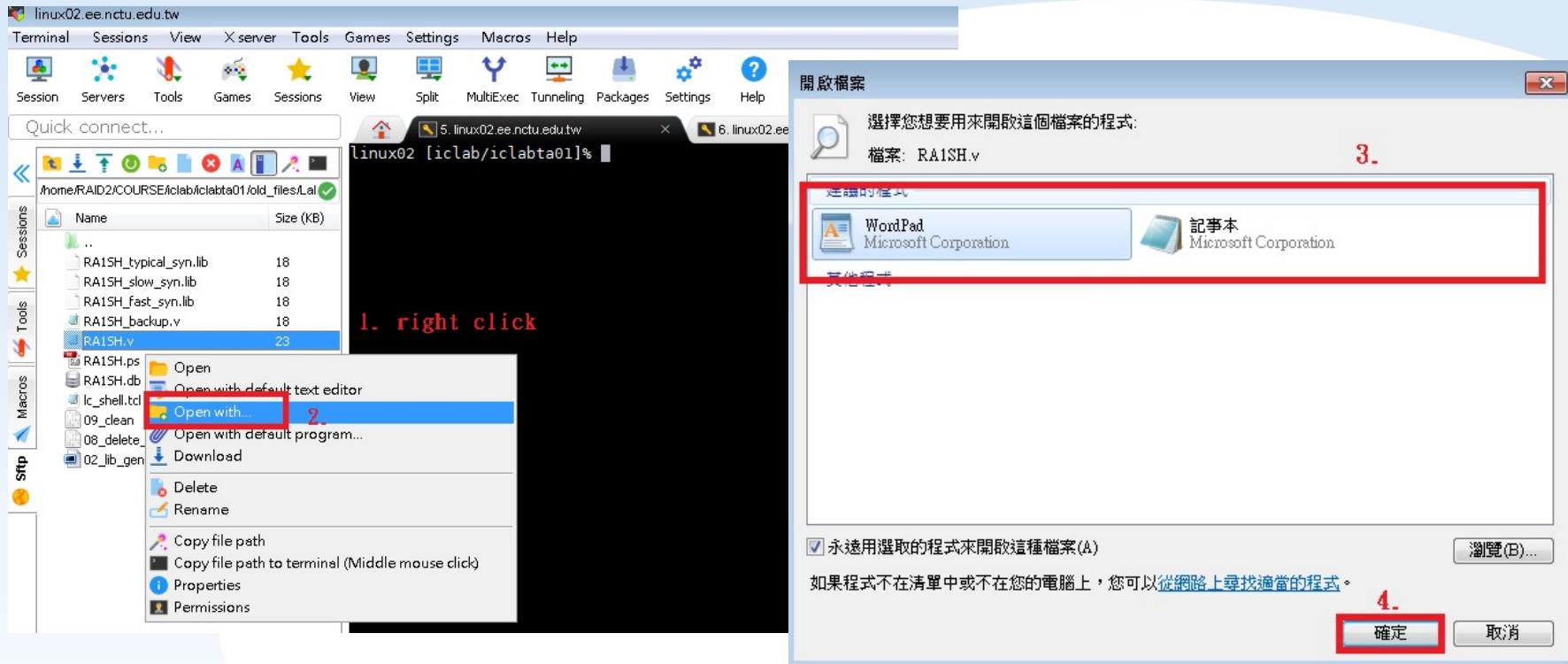
- Manually
- Supported by Mobaxterm



- Mobaxterm will download files into local computer and open it



Editor



- ✓ Can choose any editor in your computer
- ✓ If ‘notepad’ does not display clear, first use ‘wordpad’ to open it and save, then ‘notepad’ displays good

✓ Always Remember to **BACKUP**

Appendix

- ✓ **Visual Studio Code (Recommended)**
- ✓ **Vim**
- ✓ **Notepad ++**
- ✓ **Putty & Xming Setting**
(Alternative Login Software of Windos)
- ✓ **Sublime Editor**



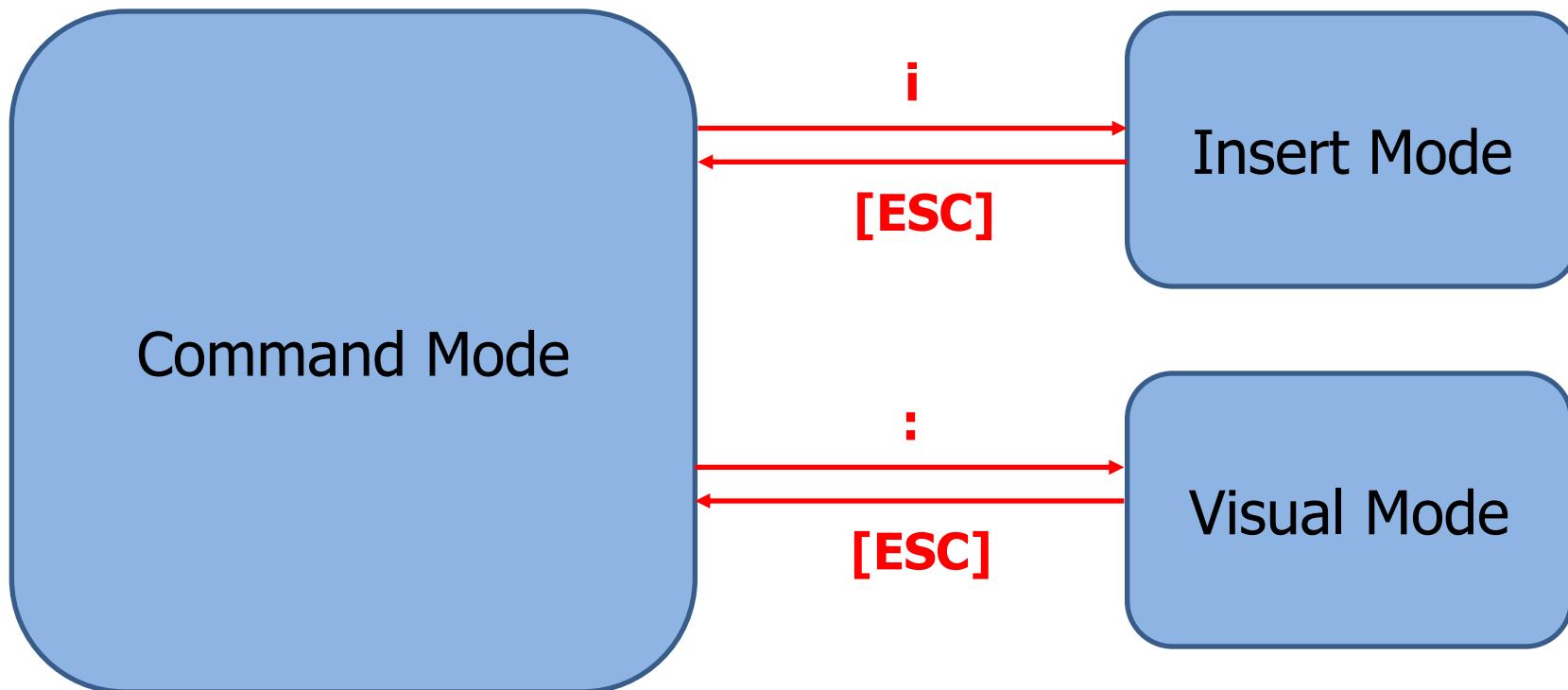
VIM



On-line Text Editor – VIM

✓ **>vi filename** //create a file

- e.g. vi test.v
- e.g. vim test.v



On-line Text Editor – VIM

✓ Command mode

- Move cursor:
 - [Page Down], [Page Up]
 - [Home], [End]
 - $\uparrow(k)\downarrow(j)\leftarrow(h)\rightarrow(l)$: move cursor
 - G: cursor moves to last column
 - nG: “n” is number. cursor moves to “n”th column
 - gg: cursor moves to the first column. (=1G)
 - n<Enter>: “n” is number. cursor moves down n columns.
- Search & Replace:
 - /word: search for “word”
 - n: search the next
 - N: search the previous



On-line Text Editor – VIM

- Delete & Copy & Paste:
 - [delete] or x: delete the character under the cursor.
 - X: delete the character before the cursor.
 - dd: delete a column where the cursor located at.
 - ndd: “n” is number. delete “n” columns.
 - yy: copy a column where the cursor located at.
 - nyy: “n” is number. copy “n” columns.
 - u: recover.
 - . : repeat the previous action.
 - [Shift]+v : select the column where the cursor located at.
 - [Ctrl]+v+[Shift]+l : edit multi-line.



On-line Text Editor – VIM

✓ Insert mode:

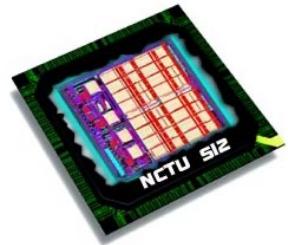
- i : switch to insert mode before the current position.
- [Esc]: switch from the insert mode to the command mode

✓ Visual mode:

- :w : write the current buffer to disk.
- :q : closes current window.
- :wq : write the current buffer to disk and closes current window.
- :q! : closes current window forcibly.
- :set nu : display the column number.



Notepad++



Text Editor – notepad++



<https://notepad-plus-plus.org/>

The screenshot shows the Notepad++ website. On the left, there's a sidebar with links like home, download, news, features, resources, contribute, donate, community, contributors, and links. Below that is a download button for version 6.8.3. The main content area has a 'News' section with a list of releases, and an 'About' section with information about the software. A code editor window is overlaid on the page, showing a snippet of C++ code.

News

- Notepad++ 6.8.3 released
Sep 04 2015
- Notepad++ 6.8.2 released
Aug 20 2015
- Notepad++ 6.8.1 released
Aug 04 2015
- Notepad++ 6.8 released
Jul 21 2015
- Notepad++ Community
Jun 27 2015
- Notepad++ 6.7.9.2 released
Jun 23 2015
- Notepad++ 6.7.9.1 released
Jun 21 2015
- Notepad++ leaves SourceForge
Jun 14 2015
- Notepad++ 6.7.9 released
Jun 12 2015
- Notepad++ 6.7.8.2 released
May 23 2015

About

Notepad++ is a free (as in "free speech" and also as in "free beer") source code editor and Notepad replacement that supports several languages. Running in the MS Windows environment, its use is governed by [GPL License](#).

Based on the powerful editing component [Scintilla](#), Notepad++ is written in C++ and uses pure Win32 API and STL which ensures a higher execution speed and smaller program size. By optimizing as many routines as possible without losing user friendliness, Notepad++ is trying to reduce the world carbon dioxide emissions. When using less CPU power, the PC can throttle down and reduce power consumption, resulting in a greener environment.

```
#include <GPL.h>
#include <free_software.h>

void notepad4ever()
{
    while (true)
    {
        Notepad++;
    }
}
```

You're encouraged to [translate Notepad++](#) into your native language if there's not already a translation present in the [Binary Translations page](#).

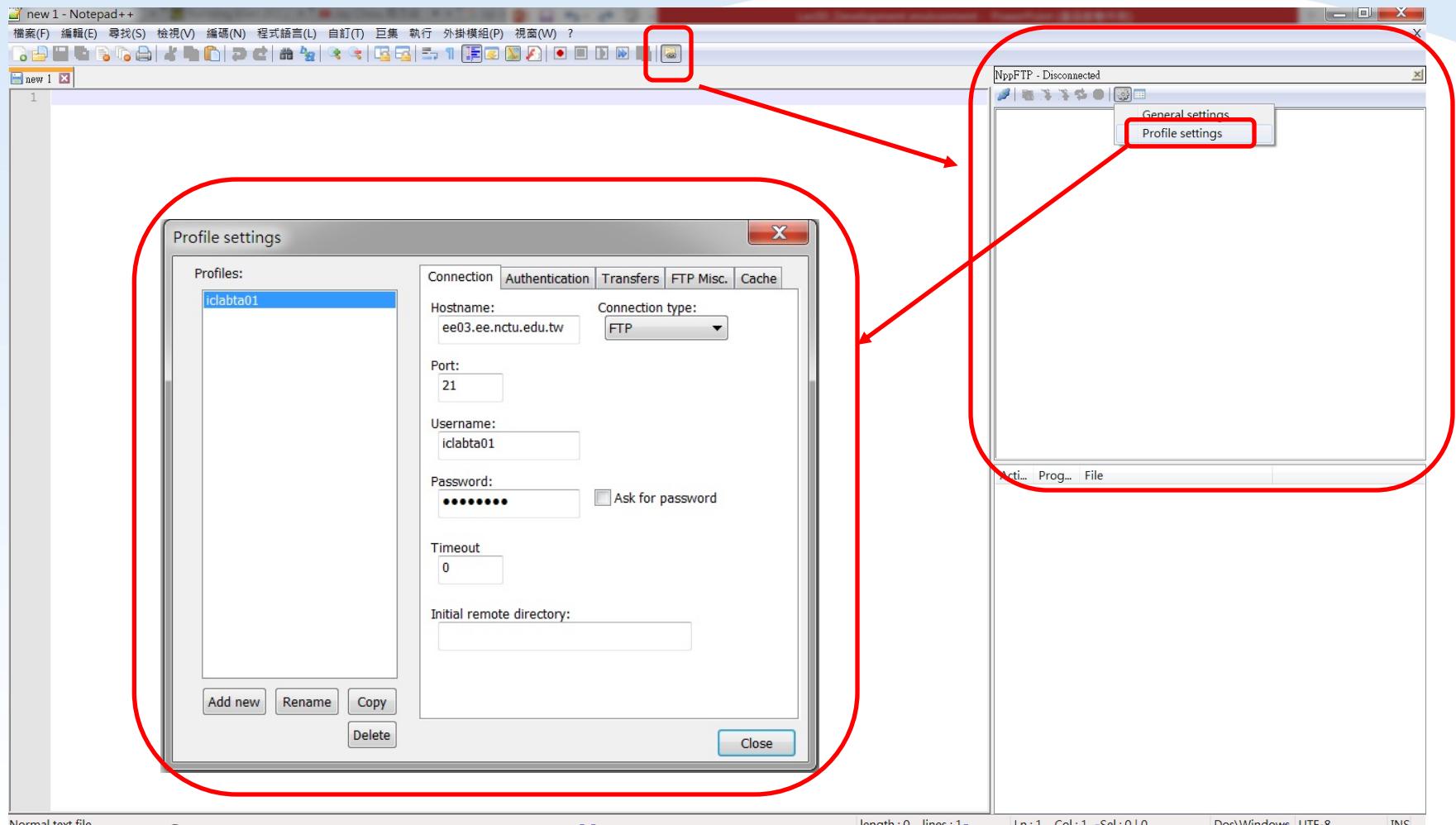
I hope you enjoy Notepad++ as much as I enjoy coding it.

Copyright © Don Ho 2015
HTML • CSS

Website kindly donated by [ecreate](#)



Text Editor – notepad++ setting



Normal text file

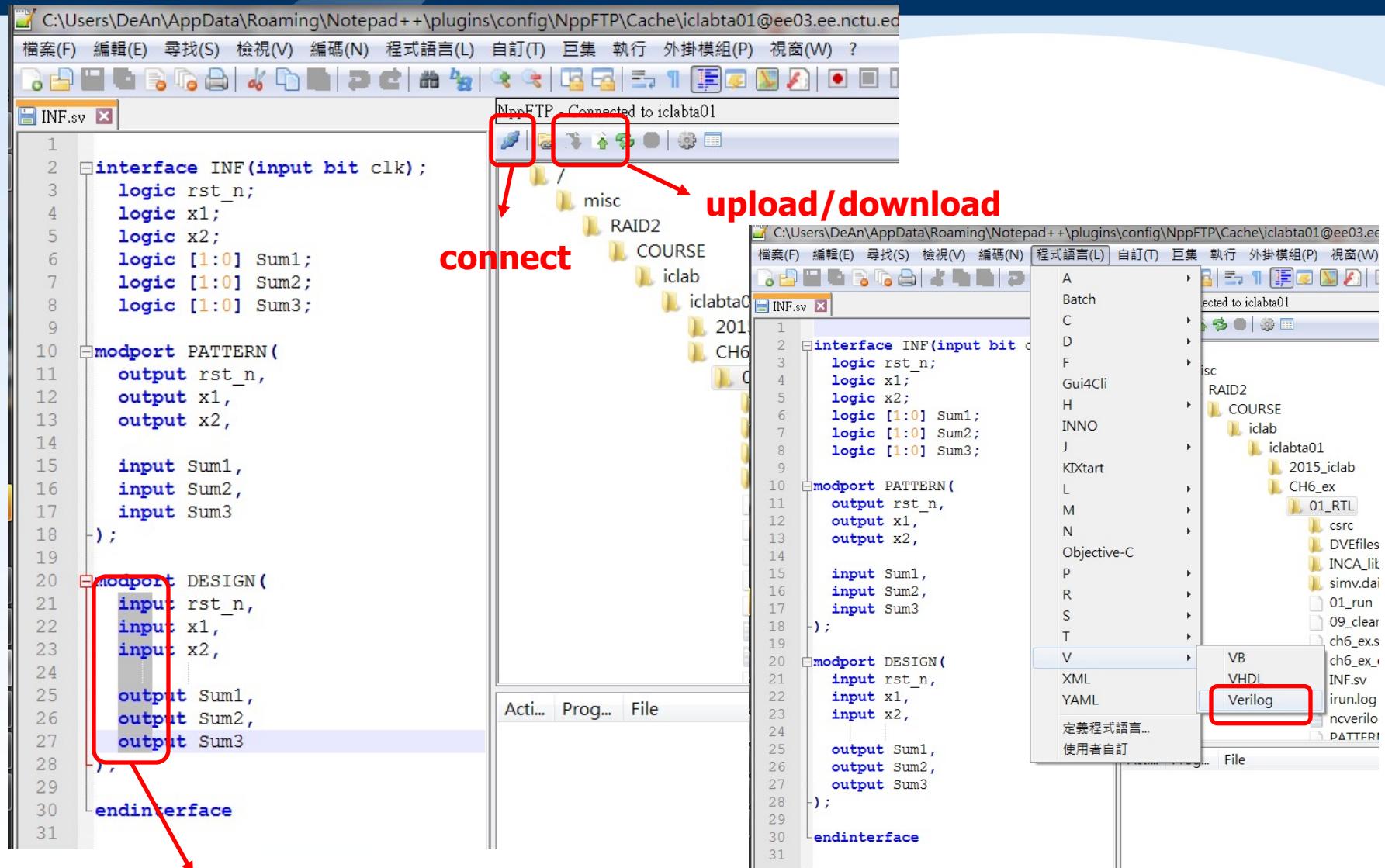
length : 0 lines : 1 Ln: 1 Col: 1 Sel: 0 | 0 Port: Windows | UTF-8

INS

Reference Video: <https://www.youtube.com/watch?v=cu8UIGFwImA>

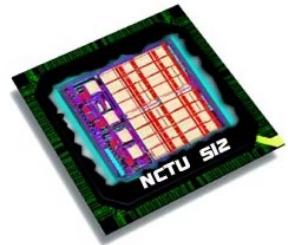


Text Editor – notepad++



Edit multi line: Alt + left mouse button

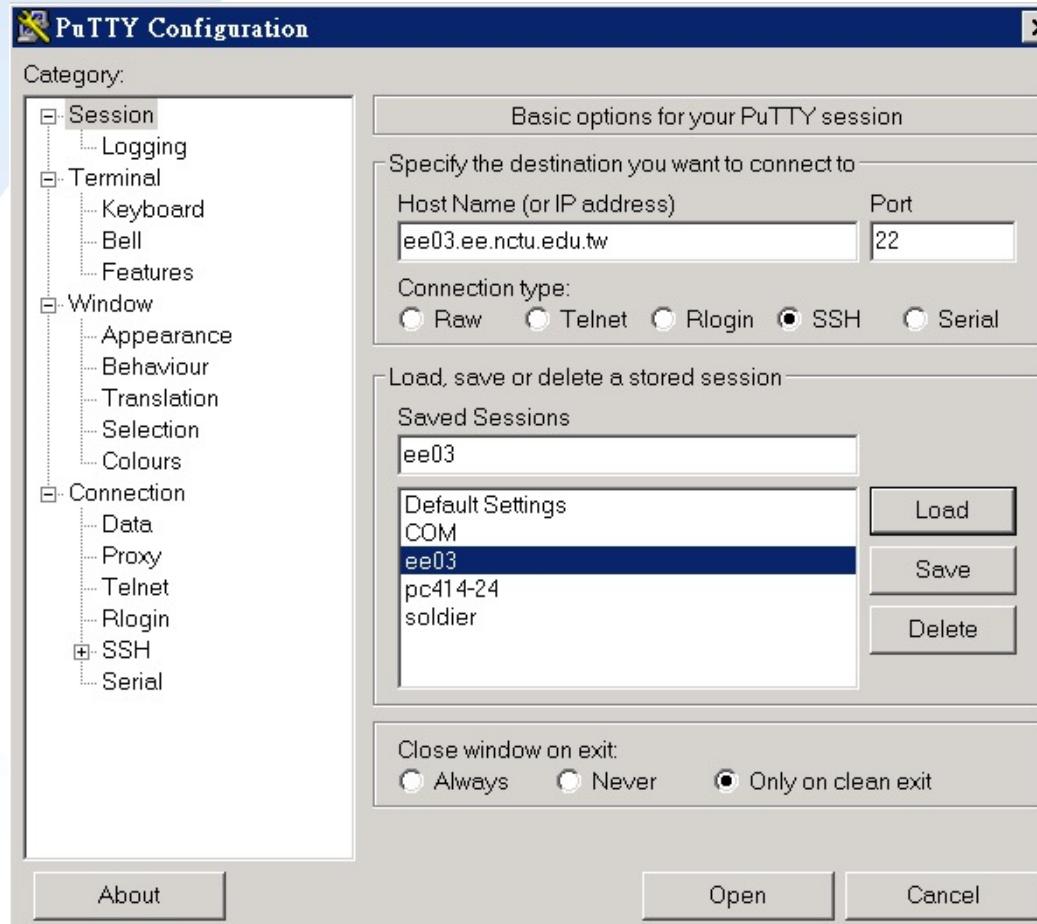
Putty & Xming



Putty & Xming

✓ Software

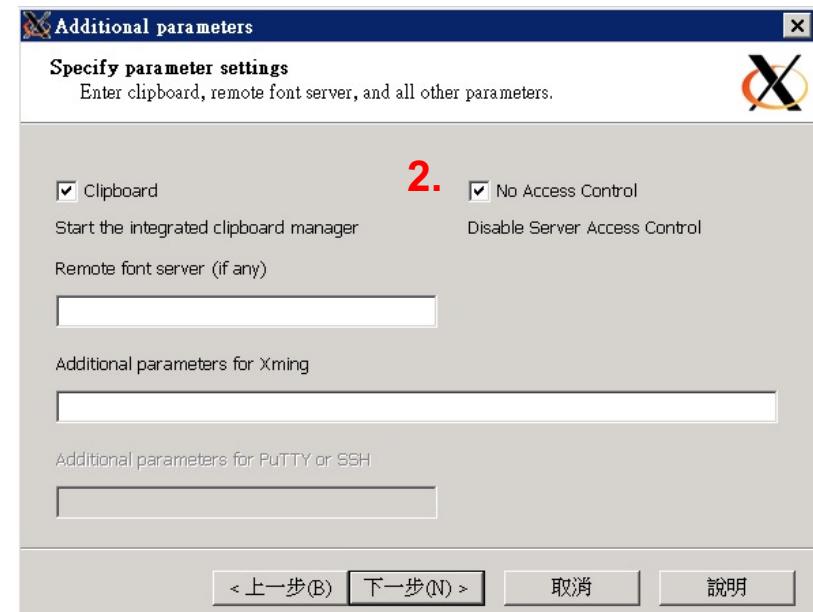
- Putty for connecting work station



Putty & Xming

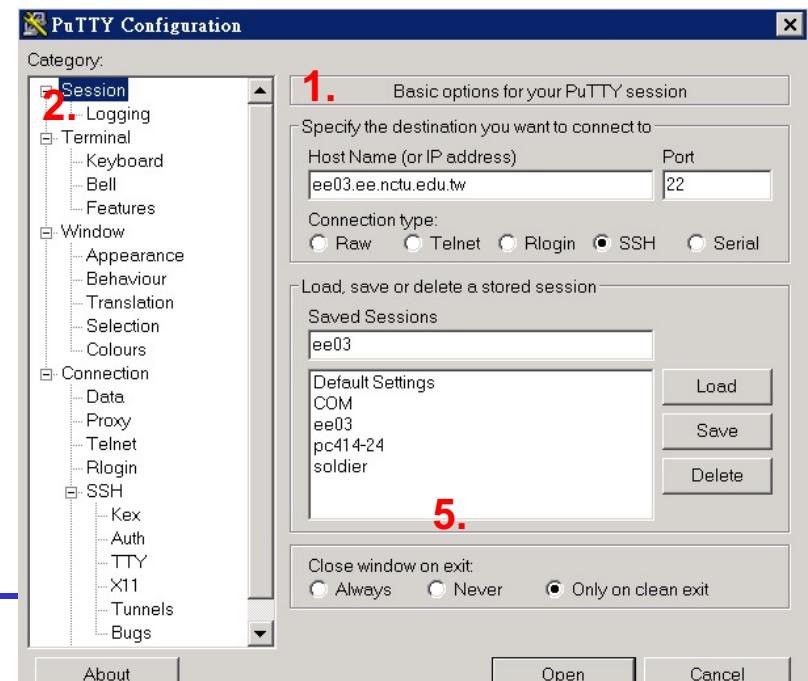
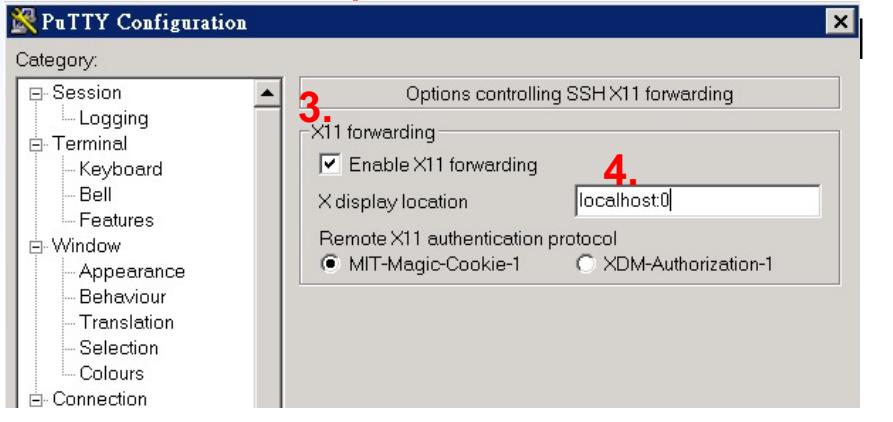
✓ Software

- Xming, Xwin-32 or other X viewer to display the GUI terminal to your computer
- Xming – Free Software
<http://sourceforge.net/projects/xming/>
<http://sourceforge.net/projects/xming/files/Xming-fonts/7.5.0.47/>
- 1. Execute **XLaunch**
2. **Check No Access Control**
3. Press **Next** or **Yes** for all other pages



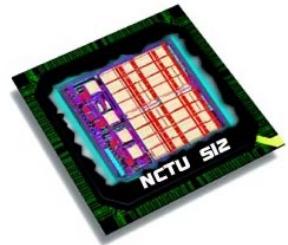
Putty & Xming

- ✓ Type setenv DISPLAY 140.113.x.x:0 in work station to display the GUI interface onto your computer
- ✓ If you're using or your IP is floating, try the following flow
 - 1. Type Host Name IP Address
 - 2. Click Category: Connection -> SSH -> X11
 - 3. Check Enable X11 forwarding
 - 4. Fill in Localhost:0
 - 5. Click Open



Sublime

Courtesy of Chieh-Yu Lin

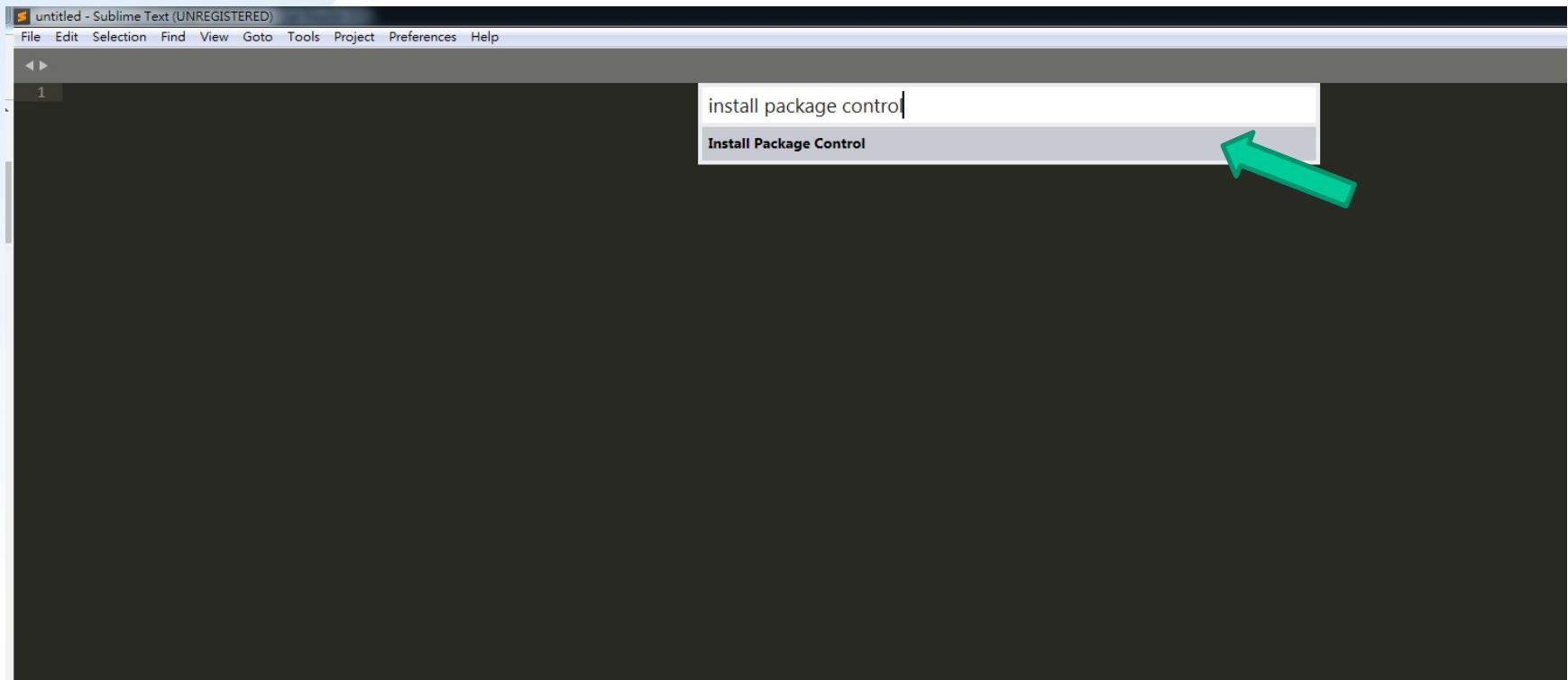


Step 1 Install Basic Plugin



Install Package Control

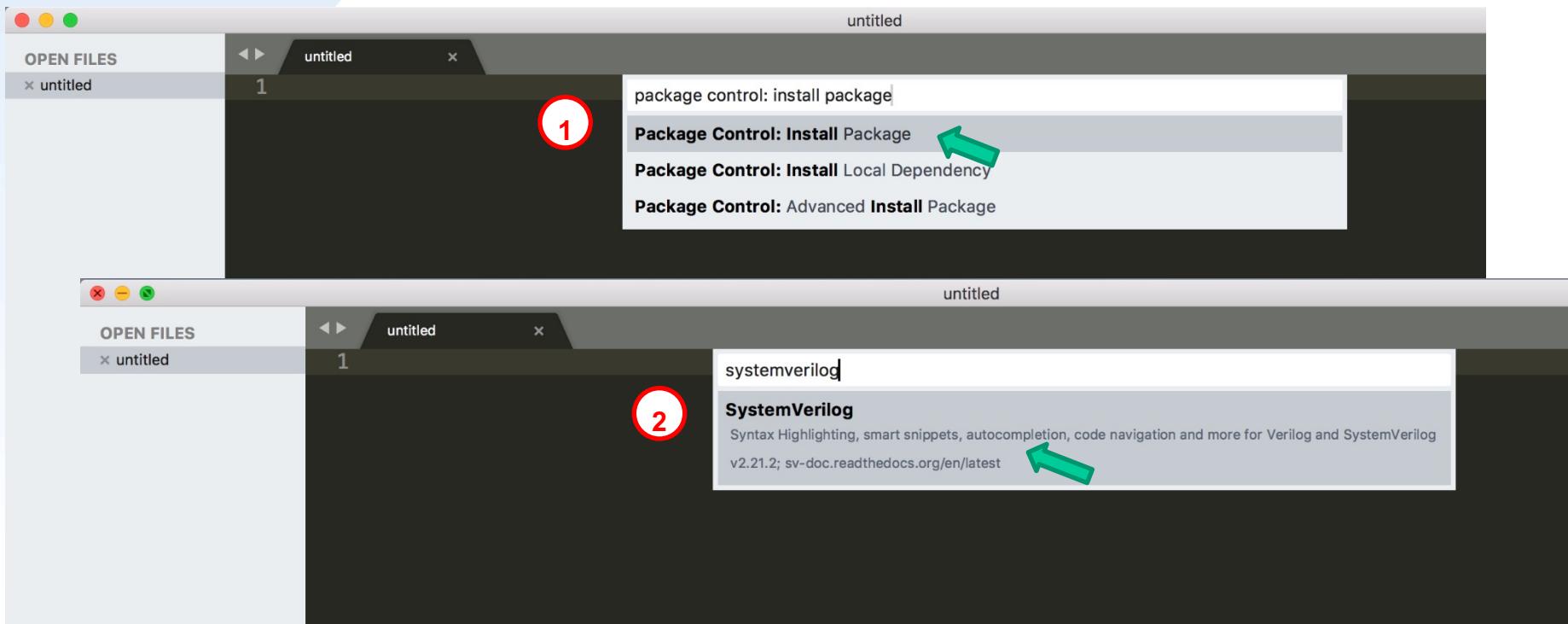
- ✓ For Mac User, Please the following “Ctrl” would be command
- ✓ (Open Command Palette (Ctrl + shift + p) → Type “install package control ” → click



Install SystemVerilog Plugin

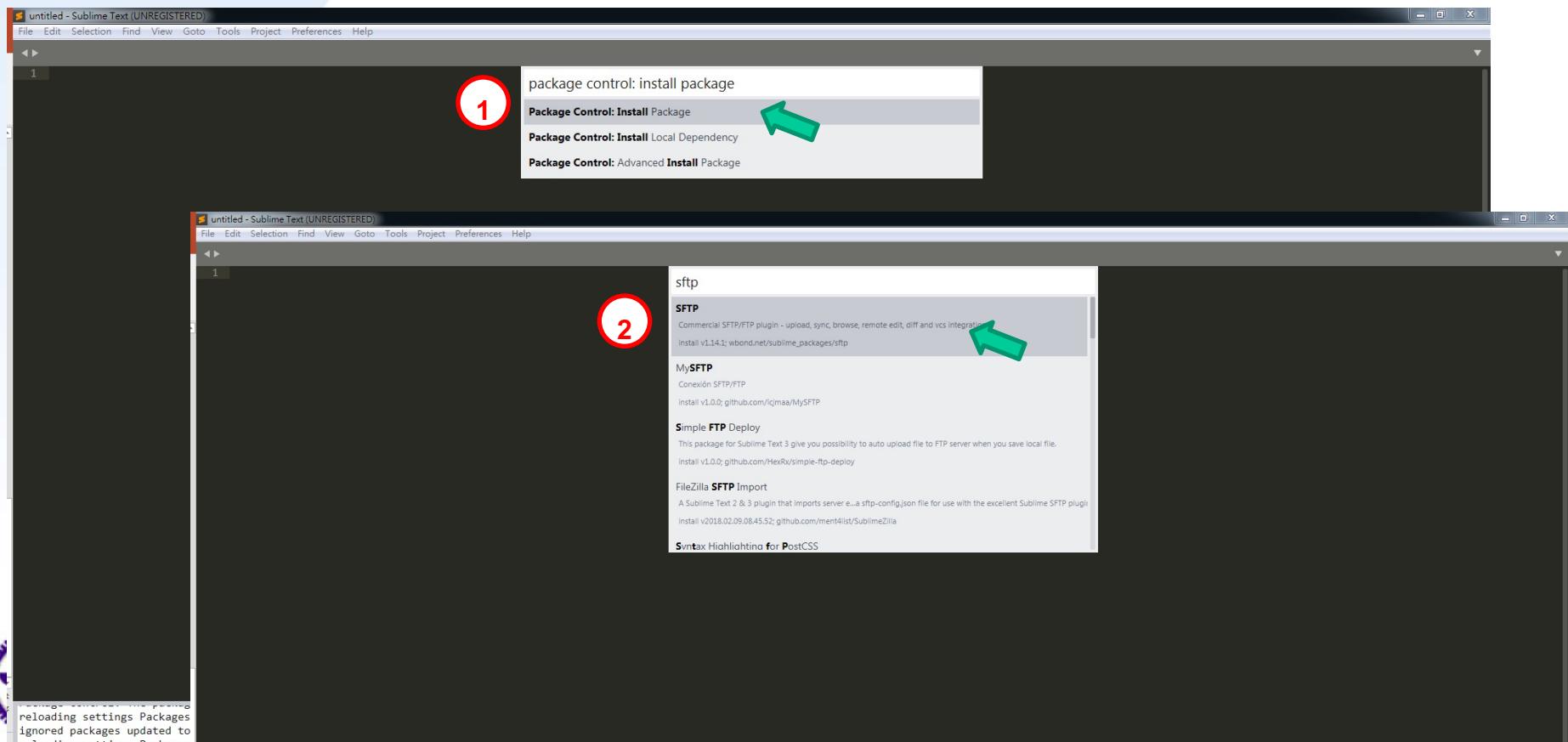
① Open Command Palette (Ctrl + shift + p) → Type “ Package Control: Install Package ” → click

② Type“ SystemVerilog ” → click



Install SFTP Plugin

- ① Open Command Palette (Ctrl + shift + p) → Type “ Package Control: Install Package ” → click
- ② Type “ SFTP ” → click

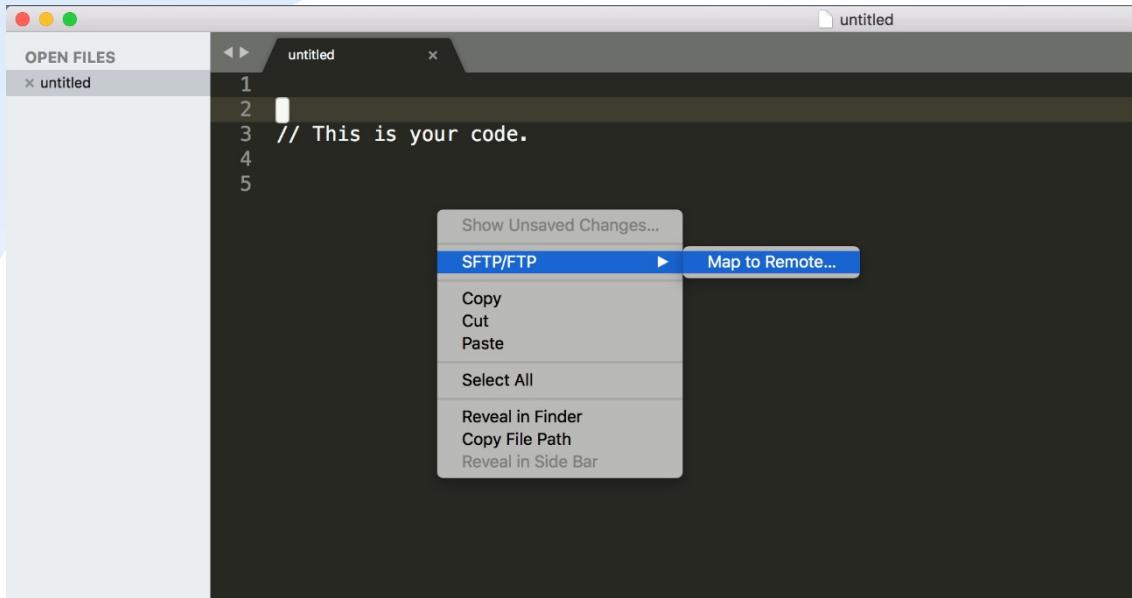


Step 2 Using SFTP Plugin to synchronize the remote file



Generate sftp-config.json

- ✓ **Method 1 : Right Click → SFTP/FTP → Map to Remote · it would generate a new “sftp-config.js” in the same folder**



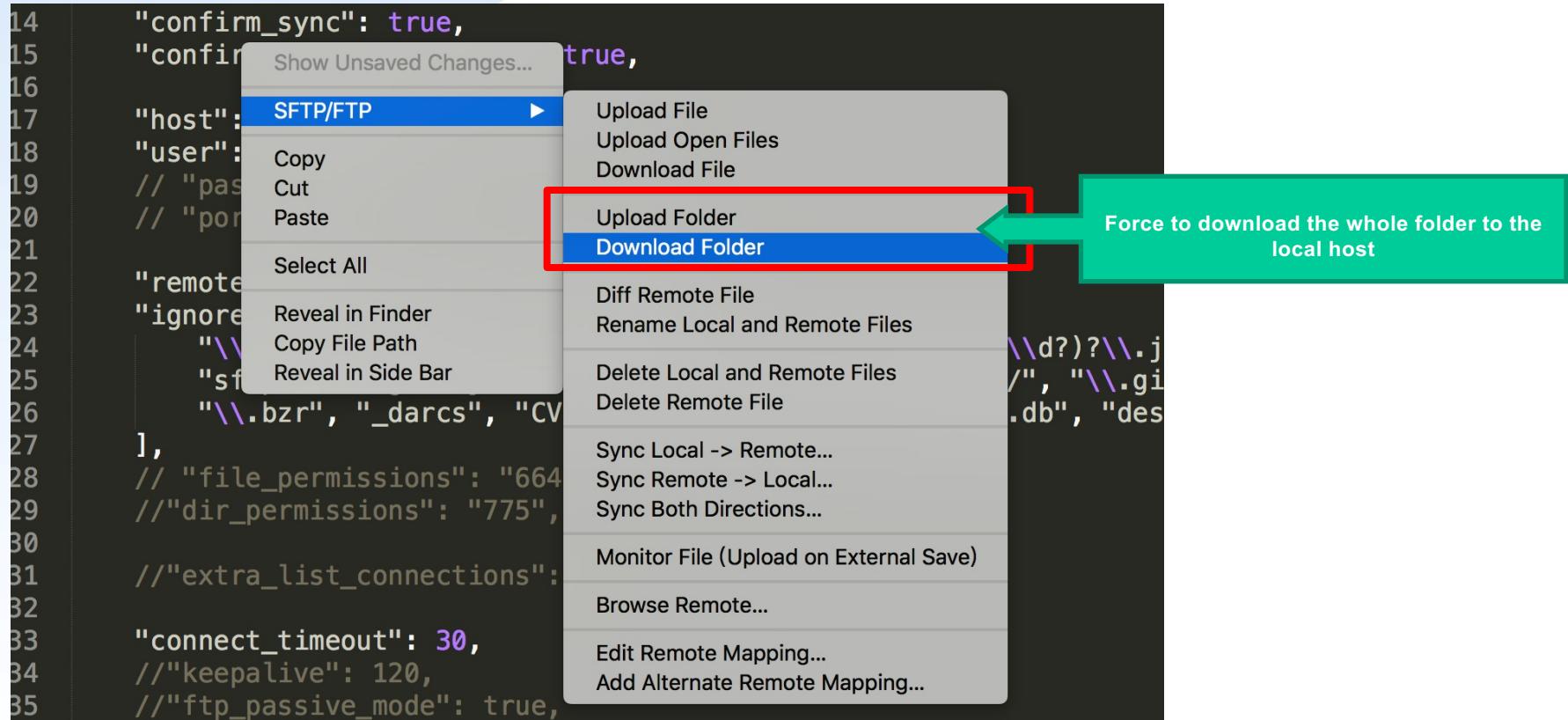
- ✓ **Method 2 (Recommended) : If you have already set your sftp-config.json, you just directly copy it into the synchronous folder, then modify the remote_path. Then You don't have to start from the blank sftp-config.json**



Setting sftp-config.json

```
sftp-config.json x
1  {
2    // The tab key will cycle through the settings when first created
3    // Visit http://wbond.net/sublime_packages/sftp/settings for help
4
5    // sftp, ftp or ftps
6    "type": "sftp",
7
8    "save_before_upload": true,           ← Upload to the server when saving the file
9    "upload_on_save": true,              ← Open the file would automatically synchronize the latest file
10   "sync_down_on_open": true,
11   "sync_skip_deletes": false,          ← back to the local host.
12   "sync_same_age": true,
13   "confirm_downloads": true,
14   "confirm_sync": true,
15   "confirm_overwrite_newer": true,
16
17   "host": "linux???.ee.ntu.edu.tw",     ← Server Directory Path ( Absolute Directory )
18   "user": "clab???",                  ←
19   // "password": "password",
20   // "port": "22",
21
22   "remote_path": "",                  ←
23   "ignore_regexes": [
24     "\\.sublime-(project|workspace)", "sftp-config(-alt\\d?)?\\.json",
25     "sftp-settings\\.json", "/venv/", "\\.svn/", "\\.hg/", "\\.git/",
26     "\\.bzr", "_darcs", "CVS", "\\.DS_Store", "Thumbs\\.db", "desktop\\.ini"
27 ],
28   // "file_permissions": "664",      32
29   // "dir_permissions": "775",       33
30   // "extra_list_connections": 0,   34
31
32
33
34
35
36
```

Upload/download Folder

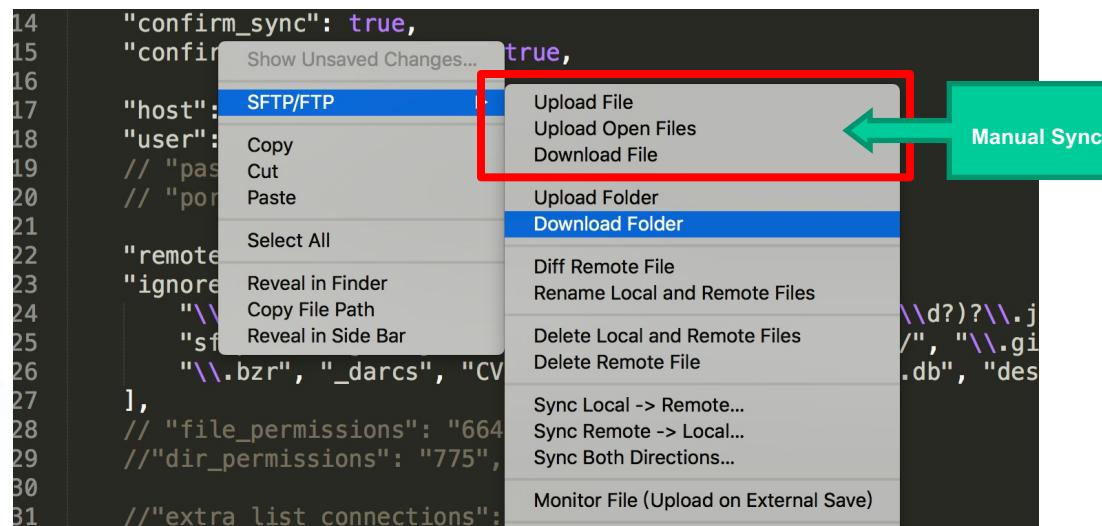


Sync Local and Remote File

✓ Automatic Sync :

- When you finish your design, Ctrl + s would save the file and automatically upload to the server
- When you open the file , it would automatically download the latest file to the local host (if **confirm_sync** is set **true**, it would have a query to sync)

✓ Manual Sync:



- ✓ Author : 2018 Ping-Yuan Tsai (bubblegame@si2lab.org)
- ✓ Modified: 2019 Li-Wei Liu (willvegapunk.ee03@g2.nctu.edu.tw)

