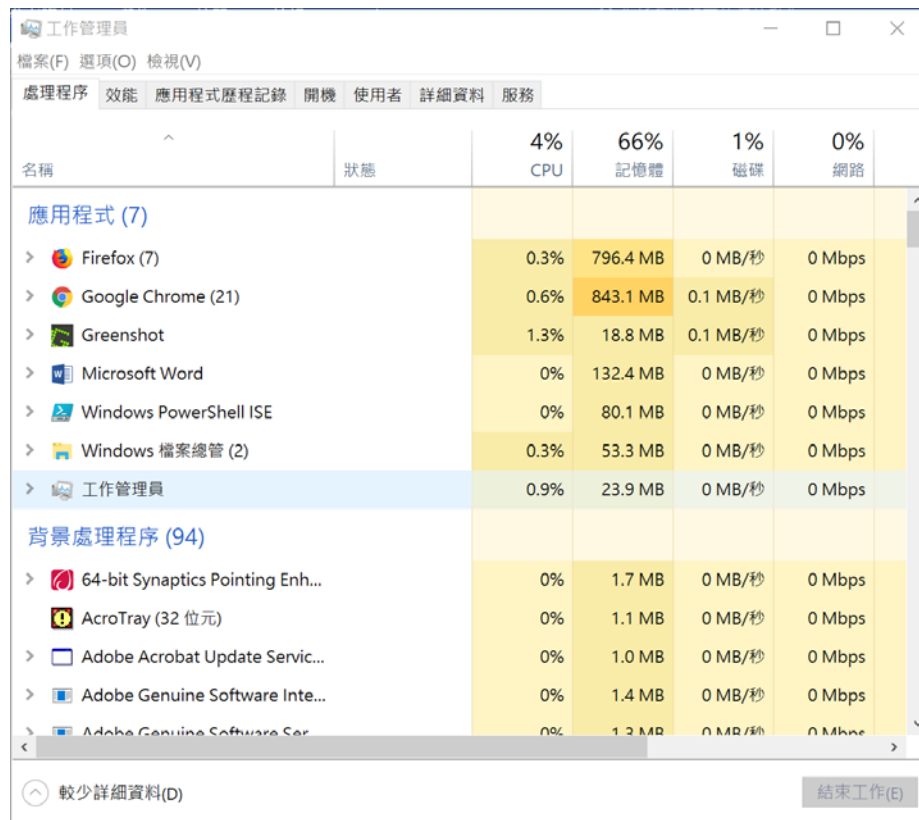


# Project #1. Resource Management

Operating systems manage the hardware and software resources on computers. Most operating systems come with built-in tools for monitoring the usage of the resources. Following are some of the well-known tools on Windows platform.

## A. Task manager (工作管理員)

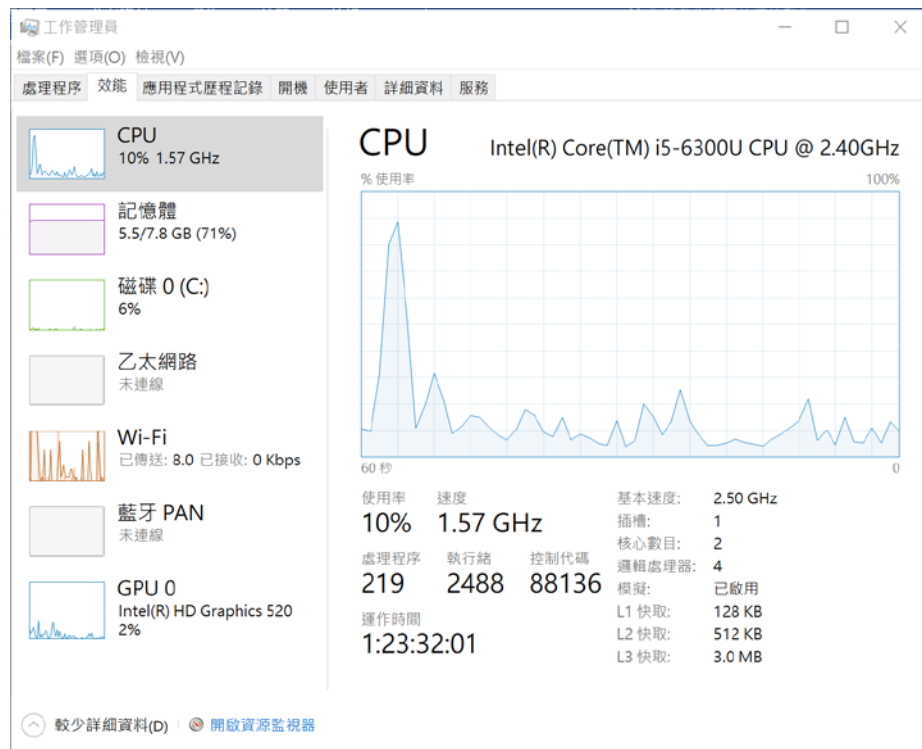
You can right click on the Windows tool bar and select 'task manager' to launch the Windows Task Manager as shown in Figure 1 and Figure 2.



The screenshot shows the Windows Task Manager window titled '工作管理員'. The '效能' (Performance) tab is selected, displaying a summary of system resource usage: CPU at 4%, Memory at 66%, Disk at 1%, and Network at 0%. Below this, a list of running processes is shown, categorized into '應用程式 (7)' (Applications) and '背景處理程序 (94)' (Background processes). Each process entry includes its name, status, and resource usage (CPU, Memory, Disk, and Network). The '工作管理員' process is highlighted in blue.

| 名稱                               | 狀態 | 4% CPU | 66% 記憶體  | 1% 磁碟    | 0% 網路  |
|----------------------------------|----|--------|----------|----------|--------|
| <strong>應用程式 (7)</strong>        |    |        |          |          |        |
| Firefox (7)                      |    | 0.3%   | 796.4 MB | 0 MB/秒   | 0 Mbps |
| Google Chrome (21)               |    | 0.6%   | 843.1 MB | 0.1 MB/秒 | 0 Mbps |
| Greenshot                        |    | 1.3%   | 18.8 MB  | 0.1 MB/秒 | 0 Mbps |
| Microsoft Word                   |    | 0%     | 132.4 MB | 0 MB/秒   | 0 Mbps |
| Windows PowerShell ISE           |    | 0%     | 80.1 MB  | 0 MB/秒   | 0 Mbps |
| Windows 檔案總管 (2)                 |    | 0.3%   | 53.3 MB  | 0 MB/秒   | 0 Mbps |
| 工作管理員                            |    | 0.9%   | 23.9 MB  | 0 MB/秒   | 0 Mbps |
| <strong>背景處理程序 (94)</strong>     |    |        |          |          |        |
| 64-bit Synaptics Pointing Enh... |    | 0%     | 1.7 MB   | 0 MB/秒   | 0 Mbps |
| AcroTray (32 位元)                 |    | 0%     | 1.1 MB   | 0 MB/秒   | 0 Mbps |
| Adobe Acrobat Update Servic...   |    | 0%     | 1.0 MB   | 0 MB/秒   | 0 Mbps |
| Adobe Genuine Software Inte...   |    | 0%     | 1.4 MB   | 0 MB/秒   | 0 Mbps |
| Adobe Genuine Software Ser...    |    | 0%     | 1.3 MB   | 0 MB/秒   | 0 Mbps |

**Figure 1. Windows Task Manager showing the list of running processes and their respective resource usages**



**Figure 2. Windows Task Manager showing the overall resource usages on the system**

You may find walkthrough articles on the Internet:

<https://www.lifewire.com/task-manager-walkthrough-4029769>

<https://www.howtogeek.com/108742/how-to-use-the-new-task-manager-in-windows-8/>

## B. Resource Monitor (資源監視器)

The Windows resource monitor (Figure 3) shows how the resources (CPU, memory, Disk I/O) are consumed by each process.

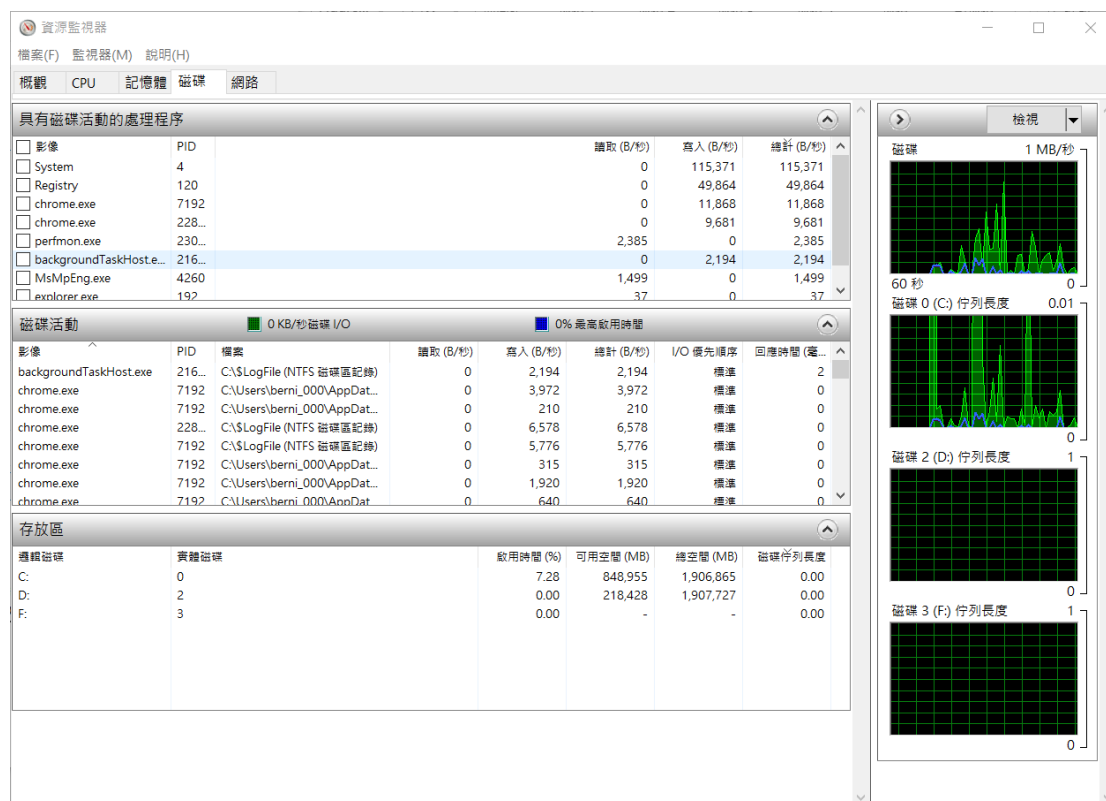


Figure 3. Resource Monitor showing the detailed resource usages

## C. Process Explorer

Process explorer is a very popular third-party tool for showing the resource usages by the running processes. It provides a lot more details in which we will cover later in this course. A neat feature is that you can save the monitoring data by clicking File -> Save.

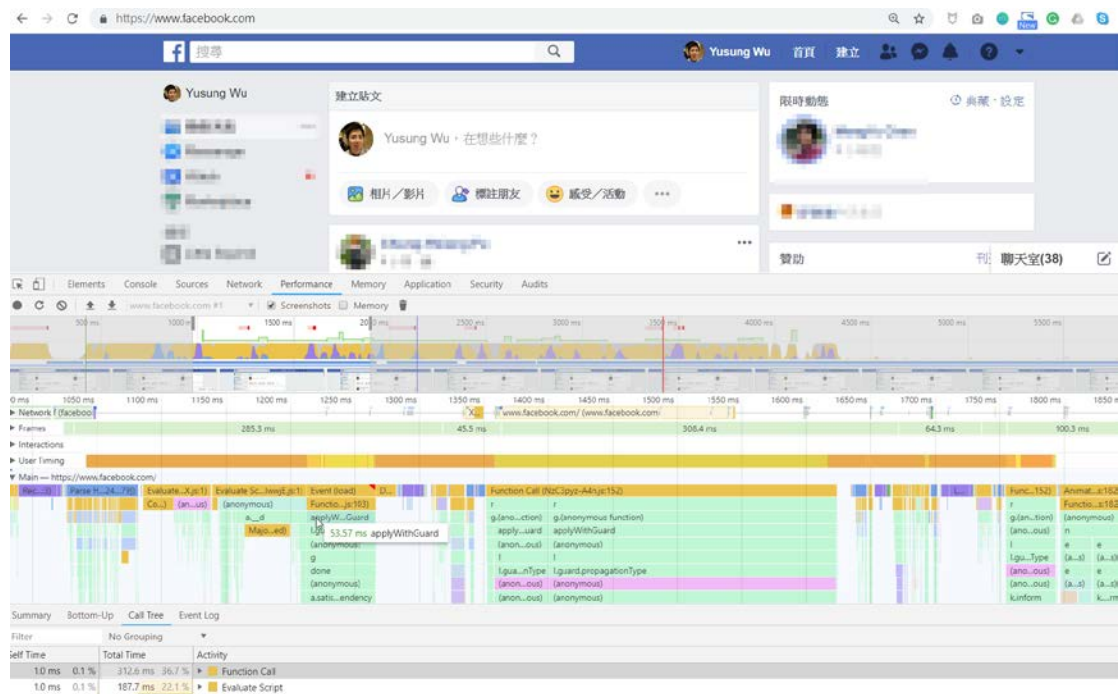
<https://docs.microsoft.com/en-us/sysinternals/downloads/process-explorer>

| Process                  | CPU | I/O Read | I/O Write | Private Bytes | Working Set | PID   | Description         | Company Name     |
|--------------------------|-----|----------|-----------|---------------|-------------|-------|---------------------|------------------|
| IntelCpHeciSvc.exe       |     |          |           | 1,408 K       | 4,736 K     | 5384  | IntelCpHeciSvc E... | Intel Corporatic |
| IntelCpHDCPSvc.exe       |     |          |           | 1,436 K       | 4,712 K     | 4644  | Intel HD Graphic... | Intel Corporatic |
| IneBroker.exe            |     |          |           | 3,060 K       | 9,660 K     | 7760  | Microsoft IME       | Microsoft Corpo. |
| igfxEM.exe               |     | 16.0 MB  | 34.8 KB   | 7,564 K       | 26,596 K    | 928   | igfxEM Module       | Intel Corporatic |
| igfxCUIService.exe       |     |          |           | 1,740 K       | 6,248 K     | 2144  | igfxCUIService M... | Intel Corporatic |
| ibtsiva.exe              |     |          |           | 1,116 K       | 3,168 K     | 4840  | Intel(R) Wireles... | Intel Corporatic |
| ibmpmsvc.exe             |     |          |           | 2,000 K       | 5,308 K     | 2488  | Lenovo Power Man... | Lenovo.          |
| googledrivesync.exe      |     | 47.8 MB  | 75.6 MB   | 2,772 K       | 3,188 K     | 14716 |                     |                  |
| googleCrashHandler64.exe |     |          |           | 1,656 K       | 464 K       | 10456 |                     |                  |
| googleCrashHandler.exe   |     |          |           | 1,776 K       | 1,268 K     | 10448 |                     |                  |
| fontdrvhost.exe          |     |          |           | 3,292 K       | 2,688 K     | 480   |                     |                  |
| firefox.exe              |     | 95.8 MB  | 196.0 KB  | 60,376 K      | 94,720 K    | 15204 | Firefox             | Mozilla Corpora. |
| firefox.exe              |     | 95.6 MB  | 33.5 KB   | 21,240 K      | 34,176 K    | 15156 | Firefox             | Mozilla Corpora. |
| escsvc64.exe             |     |          |           | 1,596 K       | 5,568 K     | 4716  | Epson Scanner Se... | Seiko Epson Cor. |
| Dropbox.exe              |     | 112 B    | 181 B     | 1,956 K       | 7,060 K     | 3040  | Dropbox             | Dropbox, Inc.    |
| Dropbox.exe              |     |          |           | 1,392 K       | 5,876 K     | 14548 | Dropbox             | Dropbox, Inc.    |
| dllhost.exe              |     | 7.9 KB   | 158 B     | 1,580 K       | 6,228 K     | 12712 | COM Surrogate       | Microsoft Corpo. |
| dllhost.exe              |     | 6.9 MB   | 1.3 MB    | 2,240 K       | 9,504 K     | 7132  | COM Surrogate       | Microsoft Corpo. |
| DbxSvc.exe               |     |          |           | 2,576 K       | 4,140 K     | 4792  | Dropbox Service     | Dropbox, Inc.    |
| dasHost.exe              |     |          |           | 7,520 K       | 12,220 K    | 2872  |                     |                  |
| CxUtilSvc.exe            |     |          |           | 1,540 K       | 5,284 K     | 4688  | Utility Service     | Conexant System. |
| CxAudMsg64.exe           |     |          |           | 1,948 K       | 5,752 K     | 4700  | Conexant Audio M... | Conexant System. |
| ctmon.exe                |     | 1.1 MB   |           | 8,636 K       | 18,636 K    | 8424  |                     |                  |
| csrss.exe                |     |          |           | 1,776 K       | 4,364 K     | 628   |                     |                  |
| conhost.exe              |     |          |           | 3,552 K       | 3,400 K     | 4488  |                     |                  |
| conhost.exe              |     |          |           | 5,444 K       | 520 K       | 17248 | 主控台視窗主機             | Microsoft Corpo. |
| cmd.exe                  |     |          |           | 1,952 K       | 272 K       | 11936 | Windows 命令處理...     | Microsoft Corpo. |
| chrome.exe               |     | 113.0 MB | 17.9 MB   | 332,288 K     | 325,476 K   | 5452  | Google Chrome       | Google Inc.      |
| chrome.exe               |     | 86.8 MB  | 244.9 KB  | 22,460 K      | 24,468 K    | 8136  | Google Chrome       | Google Inc.      |

CPU Usage: 14.42% Commit Charge: 75.51% Processes: 220 Physical Usage: 68.12%

#### D. Web Browser Console (網頁主控台)

The web browser by itself is also an operating system. A web application typically consist of multiple components (HTML, Javascript, CSS, plugins, Flash, etc.) from many sources. The web browser console can show the details of the components and resource usages. The console can be invoked by pressing F12 or Ctrl+Shift+I on most browsers (e.g., Firefox, Chrome, etc.)



<https://developers.google.com/web/tools/chrome-devtools/?hl=zh-tw>

<https://developers.google.com/web/tools/chrome-devtools/evaluate-performa>

[nce/timeline-tool?hl=zh-tw](https://nctucampus.com/timeline-tool?hl=zh-tw)

<https://developer.mozilla.org/zh-TW/docs/Tools>

## E. Application Workload

For the tasks of this homework, we will use the following application workloads:

**[AW\_Download].** Download Windows ISO image from CA.nctu.edu.tw

[ftp://T9830@ca.nctu.edu.tw/For\\_Windows/System/Windows/10\\_64bit/Chinese/%28C%29Windows\\_10\\_1511\\_Education\\_64bit.ISO](ftp://T9830@ca.nctu.edu.tw/For_Windows/System/Windows/10_64bit/Chinese/%28C%29Windows_10_1511_Education_64bit.ISO)

**[AW-Decompress].** Decompress the Firefox source code<sup>1</sup>

|                                   |
|-----------------------------------|
| 7z x firefox-65.0b9.source.tar.xz |
|-----------------------------------|

**[AW\_Untar].** Untar the Firefox source code

|                                   |
|-----------------------------------|
| 7z x firefox-65.0b9.source.tar.xz |
|-----------------------------------|

**[AW\_Mining].** Run Monero miner on your web browser. Following are a few miners you may give a try

<https://minexmr.stream/>

<https://coinhive.com/>

**Use as many 'threads' as the number of processor cores on your system.**

You can use CPU-Z<sup>2</sup> to determine the number of processor cores.

## Tasks

### A. Run [AW\_Download].

1. Observe and report the resource usages (CPU, Memory, I/O) on your system.
2. Measure the execution time.

---

<sup>1</sup> <https://archive.mozilla.org/pub/firefox/releases/65.0b9/source/firefox-65.0b9.source.tar.xz>

<sup>2</sup> <https://www.cpuid.com/softwares/cpu-z.html>

B. Run [AW-Decompress].

1. Observe and report the resource usages (CPU, Memory, I/O) on your system.
2. Measure the execution time.

C. Run [AW\_Untar].

Observe and report the resource usages (CPU, Memory, I/O) on your system.

D. Run [AW-Mining].

Observe and report the resource usages (CPU, Memory, I/O) on your system.

E. Run [AW-Download] and [AW-Mining] at the same time.

Report whether the execution time of [AW-Download] is affected as compared to the measurement in Task A

F. Run [AW-Decompress] and [AW-Mining] at the same time.

Report whether the execution time of [AW-Decompress] is affected as compared to the measurement in Task B