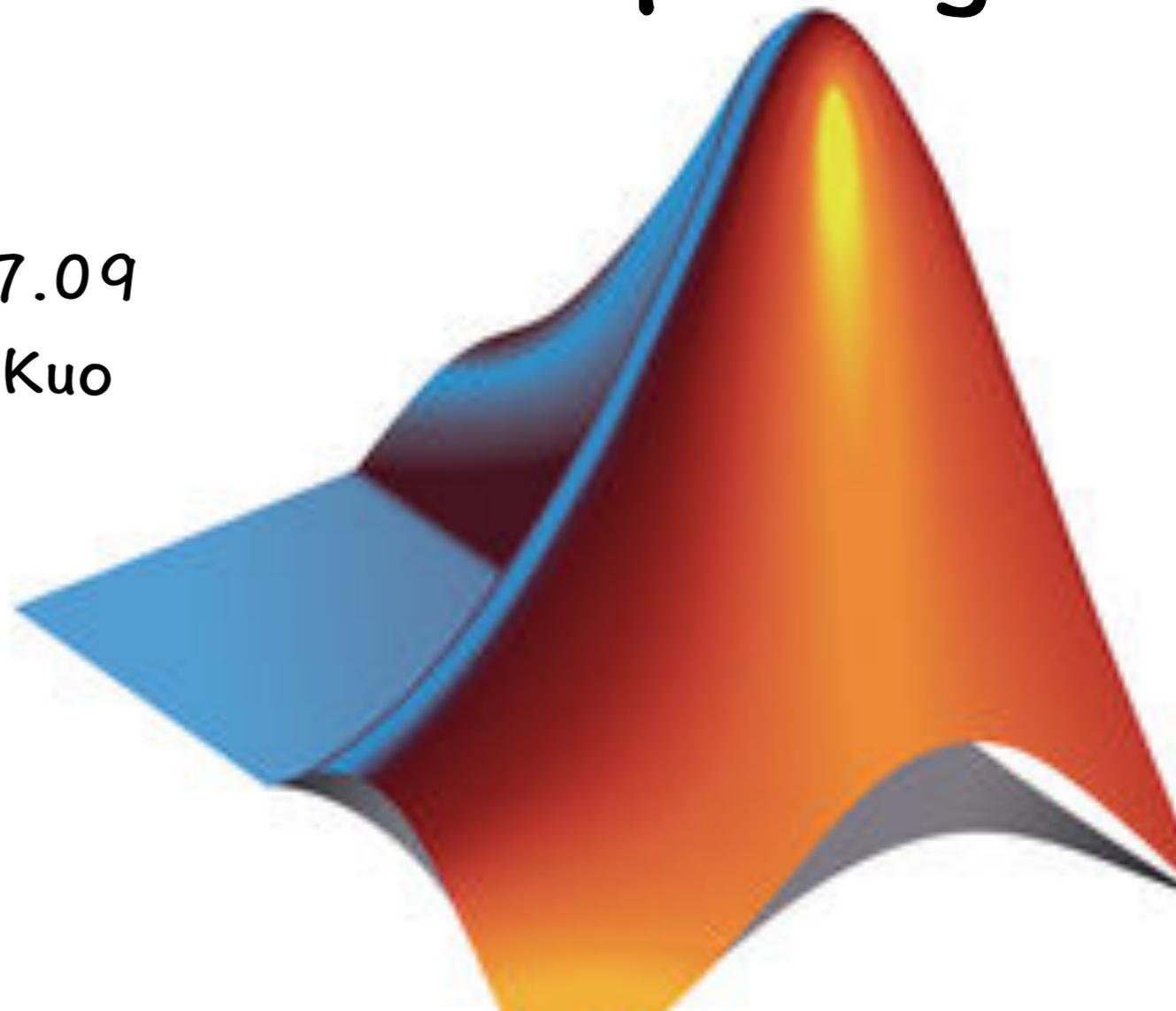


Matlab

Solve TSP with Parallel and Distributed Computing

107.07.09
Vicky Kuo



- TSP 問題是什麼呢？

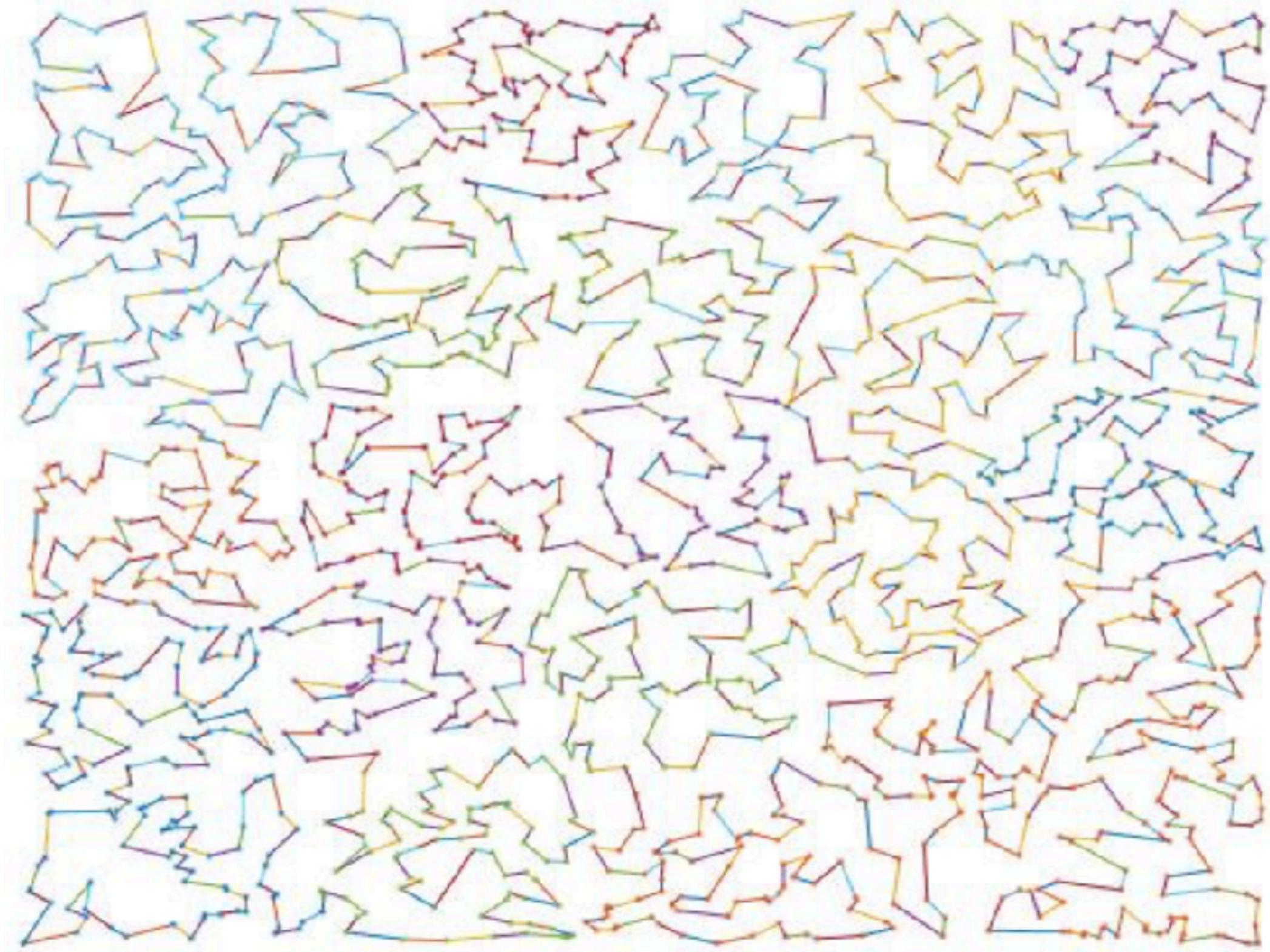
一個推銷員打算行走2000個城市，他應該怎麼走才可以用最短的距離經過每個地方呢？

想像一下~~~

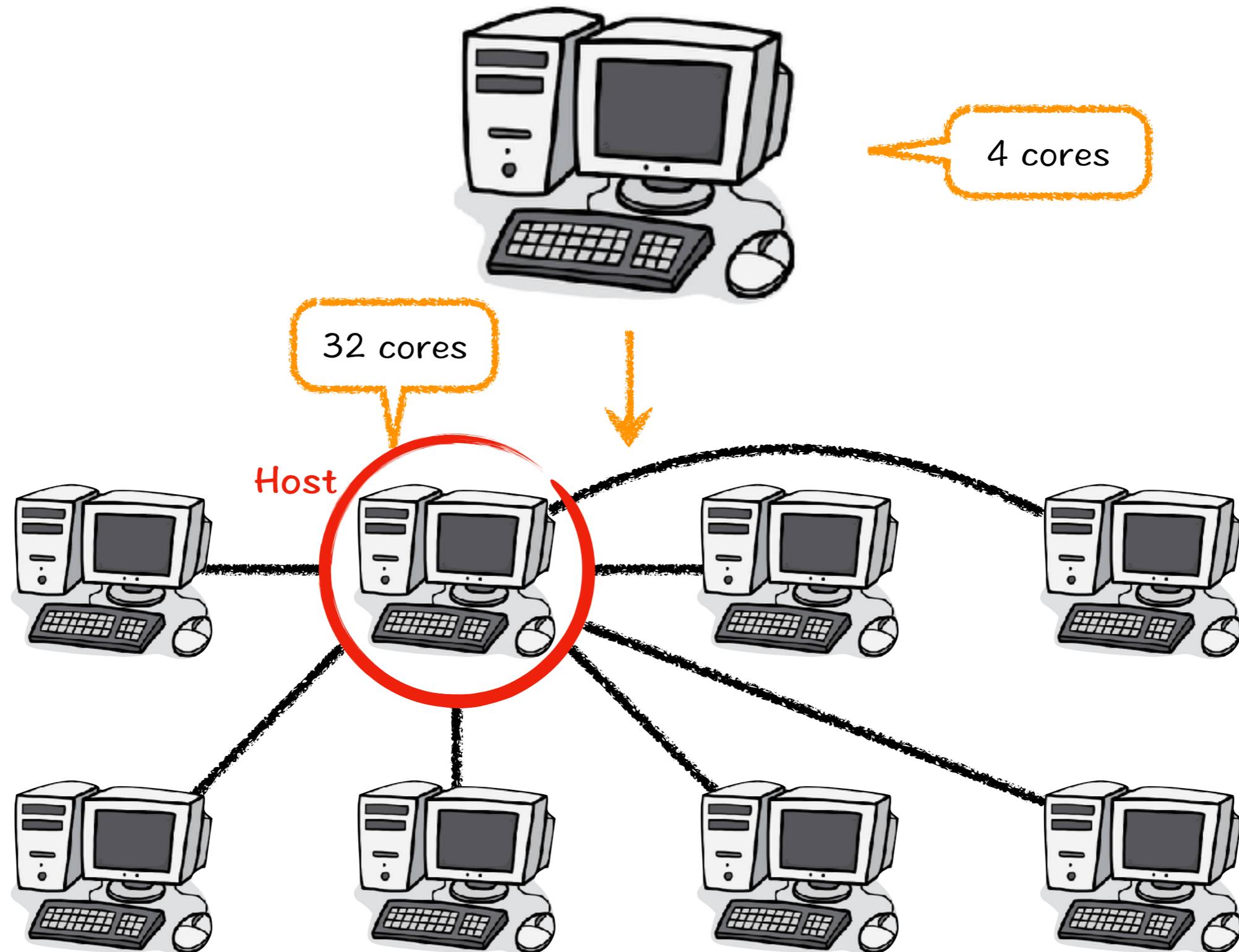
用最短的距離把2000個點連起來



- TSP for 2000 cities



- 什麼是平行分散運算(Parallel and Distributed Computing)



● 營造適合做運算的環境

- MATLAB 要有 MDCE 的工具箱

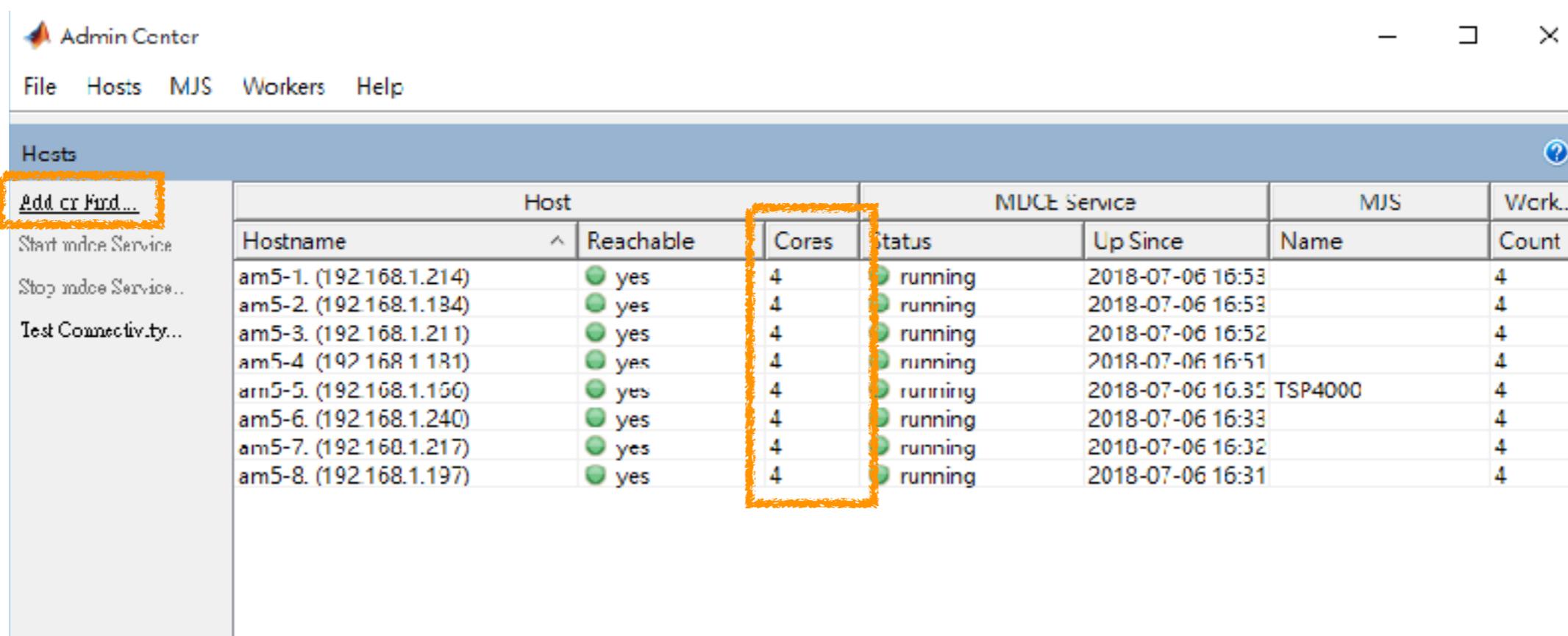
((MDCE = Matlab Distributed Computing Engine))

- 設定環境

1. 設定路徑C:\Program Files\MATLAB\R2017a\toolbox\distcomp\bin
2. 打開MATLAB，在Command Window 輸入 `!mdce install` 安裝mdce
((若已安裝 要先輸入 `!mdce uninstall` 解除mdce 再重新安裝))
3. 在Command Window 輸入 `!mdce start` 啟動mdce
4. 關閉防火牆
5. 在Admin Center作業，把所有電腦連接起來
 - ① 到C:\Program Files\MATLAB\R2017a\toolbox\distcomp\bin
 - ② 在admincenter 點選右鍵進入作設定

● 營造適合做運算的環境

- 在選為 Host 的電腦輸入所有欲連結的電腦 IP 位置
(可以到 cmd 輸入 `ipconfig/all` 查詢當台電腦的 IP)
- 在其他台電腦輸入當台的 IP 與 作為 Host 的電腦 IP



Admin Center

File Hosts MJS Workers Help

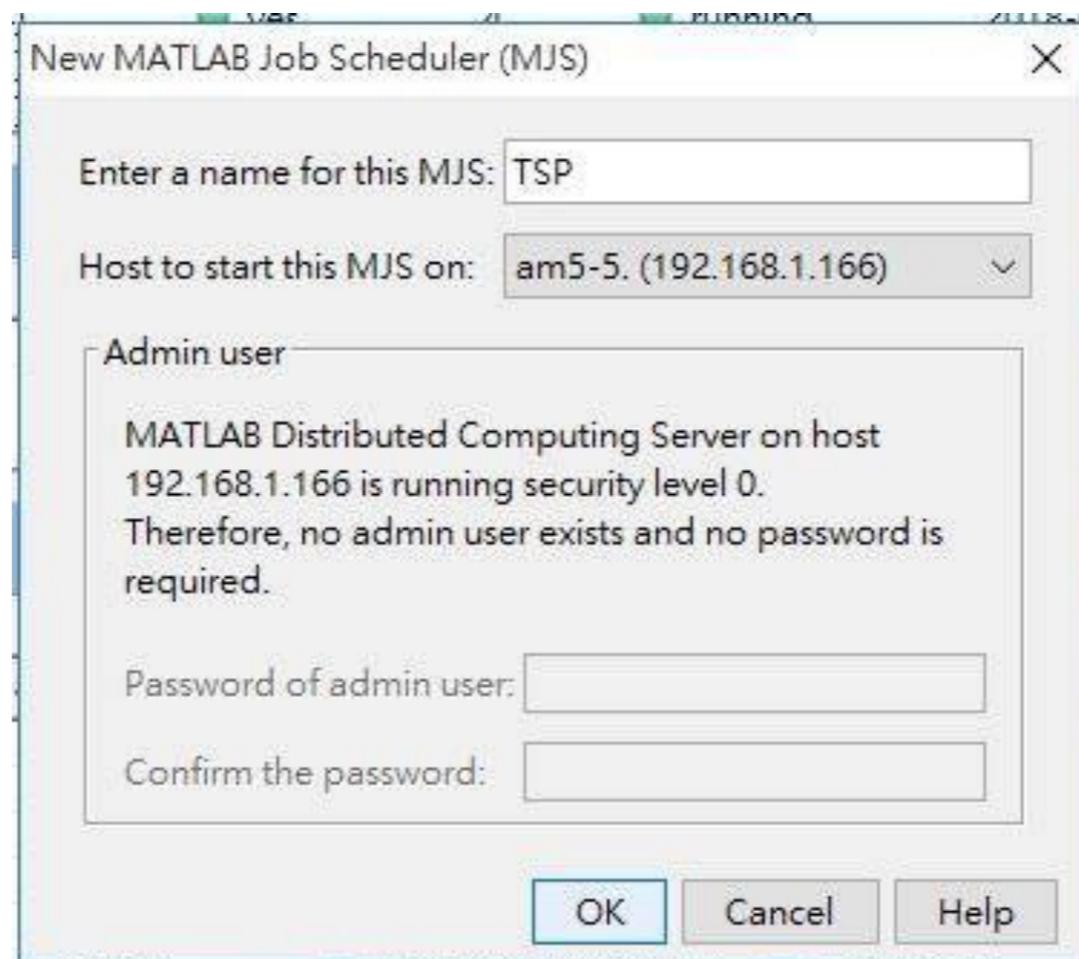
Hosts

Add or Find...

Host	MJCE Service	MJS	Wcrk...			
Hostname ^	Reachable	Cores	Status	Up Since	Name	Count
am5-1. (192.168.1.214)	● yes	4	● running	2018-07-06 16:53		4
am5-2. (192.168.1.184)	● yes	4	● running	2018-07-06 16:53		4
am5-3. (192.168.1.211)	● yes	4	● running	2018-07-06 16:52		4
am5-4. (192.168.1.181)	● yes	4	● running	2018-07-06 16:51		4
am5-5. (192.168.1.150)	● yes	4	● running	2018-07-06 16:35	TSP4000	4
am5-6. (192.168.1.240)	● yes	4	● running	2018-07-06 16:33		4
am5-7. (192.168.1.217)	● yes	4	● running	2018-07-06 16:32		4
am5-8. (192.168.1.197)	● yes	4	● running	2018-07-06 16:31		4

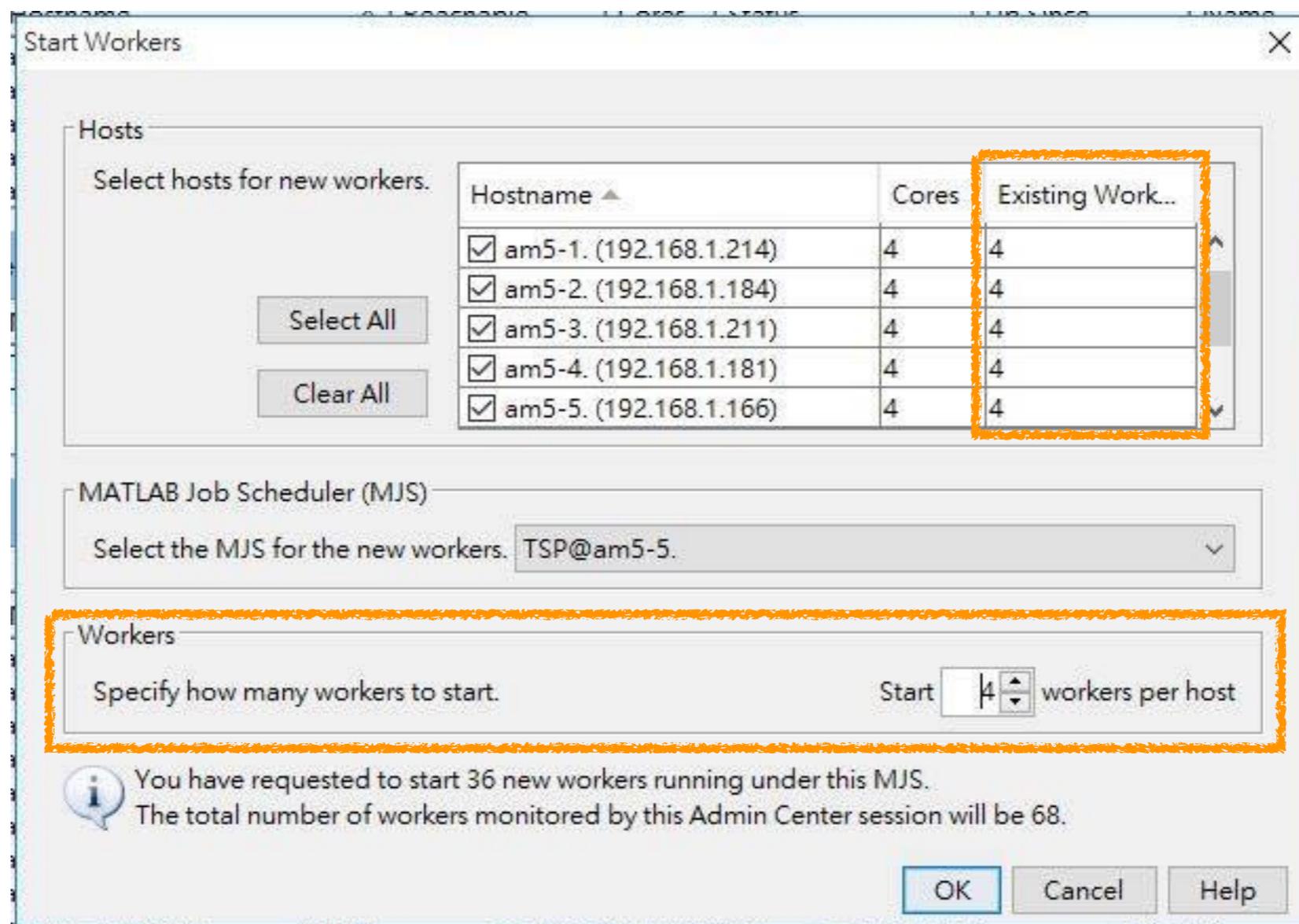
● 營造適合做運算的環境

- 在選定的 Host 電腦上建立成一個 Job



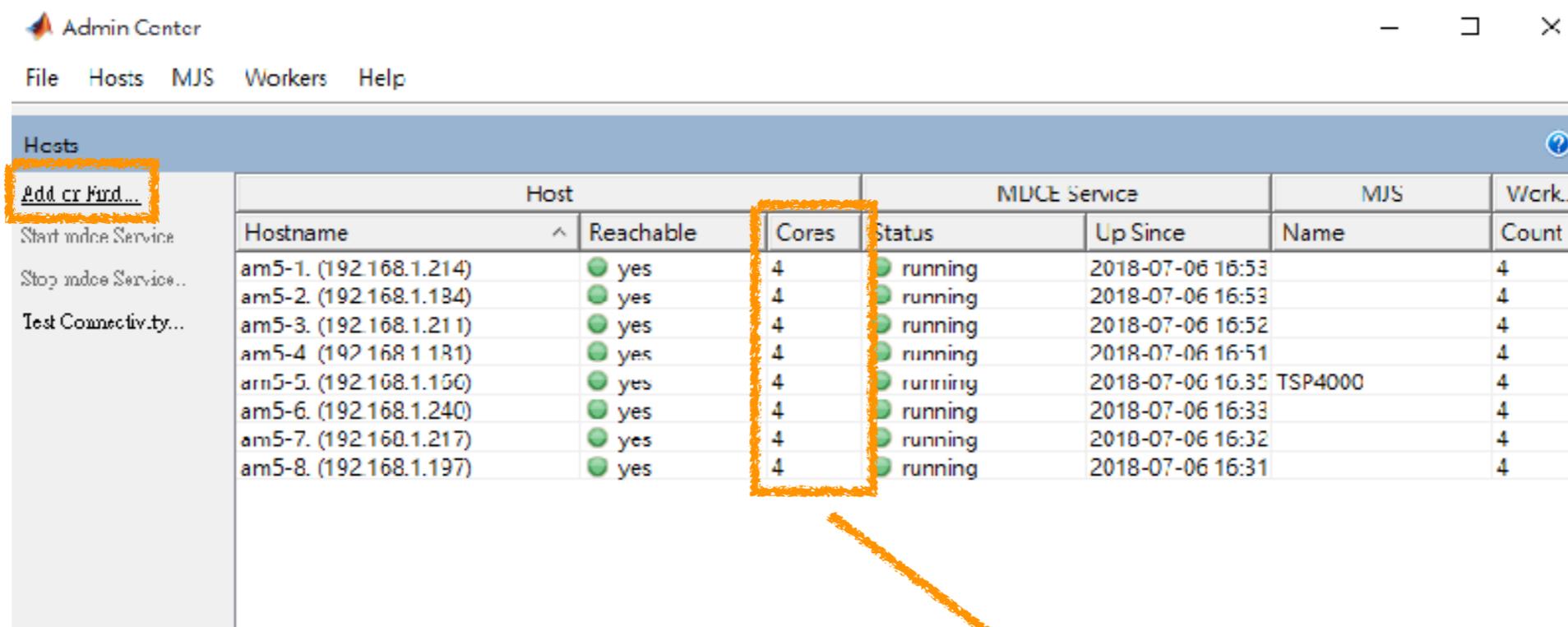
● 營造適合做運算的環境

- 啟動已經建立好的 Job
- 要注意每台電腦選取的**核心數量要一致**



● 營造適合做運算的環境

- 在選為 Host 的電腦輸入所有欲連結的電腦 IP 位置
(可以到 cmd 輸入 `ipconfig/all` 查詢當台電腦的 IP)
- 在其他台電腦輸入當台的 IP 與 作為 Host 的電腦 IP



Admin Center

File Hosts MJS Workers Help

Hosts

[Add or Find...](#)

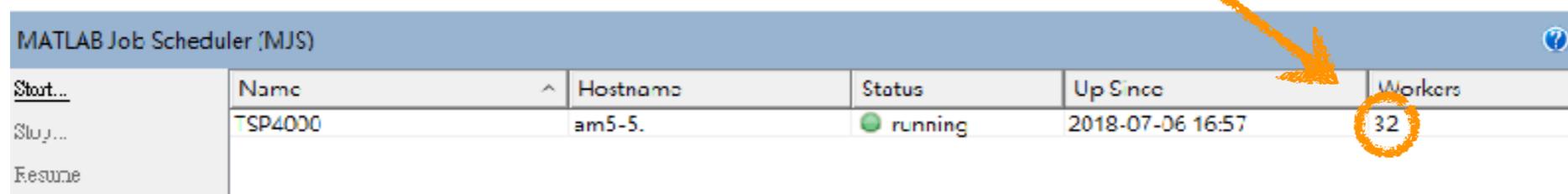
Start index Service

Stop index Service...

Test Connectivity...

Host	MJCE Service	MJS	Work...			
Hostname ^	Reachable	Cores	Status	Up Since	Name	Count
am5-1. (192.168.1.214)	● yes	4	● running	2018-07-06 16:53		4
am5-2. (192.168.1.134)	● yes	4	● running	2018-07-06 16:53		4
am5-3. (192.168.1.211)	● yes	4	● running	2018-07-06 16:52		4
am5-4. (192.168.1.131)	● yes	4	● running	2018-07-06 16:51		4
am5-5. (192.168.1.150)	● yes	4	● running	2018-07-06 16:35	TSP4000	4
am5-6. (192.168.1.240)	● yes	4	● running	2018-07-06 16:33		4
am5-7. (192.168.1.217)	● yes	4	● running	2018-07-06 16:32		4
am5-8. (192.168.1.197)	● yes	4	● running	2018-07-06 16:31		4

- 8 台各有 4 核心的電腦 → 一台擁有 32 核心的電腦



MATLAB Job Scheduler (MJS)

Start...	Name	Hostname	Status	Up Since	Workers
Stop...	TSP4000	am5-5.	● running	2018-07-06 16:57	32
Resume					

- 營造適合做運算的環境
 - 此時每個 worker 已經全部啟動

Start Stop... Resume	Worker				MIS		
	Name	Hostname	Status	Up Since	Connection	Name	Hostname
Resume	am5-1_worker01	am5-1.	● busy	2018-07-06 17:...	● connected	TSP4000	am5-5.
	am5-1_worker02	am5-1.	● busy	2018-07-06 17:...	● connected	TSP4000	am5-5.
	am5-1_worker03	am5-1.	● busy	2018-07-06 17:...	● connected	TSP4000	am5-5.
	am5-1_worker04	am5-1.	● busy	2018-07-06 17:...	● connected	TSP4000	am5-5.
	am5-2_worker01	am5-2.	● busy	2018-07-06 17:...	● connected	TSP4000	am5-5.
	am5-2_worker02	am5-2.	● busy	2018-07-06 17:...	● connected	TSP4000	am5-5.
	am5-2_worker03	am5-2.	● busy	2018-07-06 17:...	● connected	TSP4000	am5-5.
	am5-2_worker04	am5-2.	● busy	2018-07-06 17:...	● connected	TSP4000	am5-5.
	am5-3_worker01	am5-3.	● busy	2018-07-06 17:...	● connected	TSP4000	am5-5.
	am5-3_worker02	am5-3.	● busy	2018-07-06 17:...	● connected	TSP4000	am5-5.
	am5-3_worker03	am5-3.	● busy	2018-07-06 17:...	● connected	TSP4000	am5-5.
	am5-3_worker04	am5-3.	● busy	2018-07-06 17:...	● connected	TSP4000	am5-5.
	am5-4_worker01	am5-4.	● busy	2018-07-06 17:...	● connected	TSP4000	am5-5.
	am5-4_worker02	am5-4.	● busy	2018-07-06 17:...	● connected	TSP4000	am5-5.
	am5-4_worker03	am5-4.	● busy	2018-07-06 17:...	● connected	TSP4000	am5-5.
	am5-4_worker04	am5-4.	● busy	2018-07-06 17:...	● connected	TSP4000	am5-5.
Resume	am5-5_worker01	am5-5.	● busy	2018-07-06 17:...	● connected	TSP4000	am5-5.
	am5-5_worker02	am5-5.	● busy	2018-07-06 17:...	● connected	TSP4000	am5-5.
	am5-5_worker03	am5-5.	● busy	2018-07-06 17:...	● connected	TSP4000	am5-5.
	am5-5_worker04	am5-5.	● busy	2018-07-06 17:...	● connected	TSP4000	am5-5.
	am5-6_worker01	am5-6.	● busy	2018-07-06 17:...	● connected	TSP4000	am5-5.
	am5-6_worker02	am5-6.	● busy	2018-07-06 17:...	● connected	TSP4000	am5-5.
	am5-6_worker03	am5-6.	● busy	2018-07-06 17:...	● connected	TSP4000	am5-5.
	am5-6_worker04	am5-6.	● busy	2018-07-06 17:...	● connected	TSP4000	am5-5.
	am5-7_worker01	am5-7.	● busy	2018-07-06 17:...	● connected	TSP4000	am5-5.
	am5-7_worker02	am5-7.	● busy	2018-07-06 17:...	● connected	TSP4000	am5-5.
	am5-7_worker03	am5-7.	● busy	2018-07-06 17:...	● connected	TSP4000	am5-5.
	am5-7_worker04	am5-7.	● busy	2018-07-06 17:...	● connected	TSP4000	am5-5.
	am5-8_worker01	am5-8.	● busy	2018-07-06 17:...	● connected	TSP4000	am5-5.
	am5-8_worker02	am5-8.	● busy	2018-07-06 17:...	● connected	TSP4000	am5-5.
	am5-8_worker03	am5-8.	● busy	2018-07-06 17:...	● connected	TSP4000	am5-5.
	am5-8_worker04	am5-8.	● busy	2018-07-06 17:...	● connected	TSP4000	am5-5.

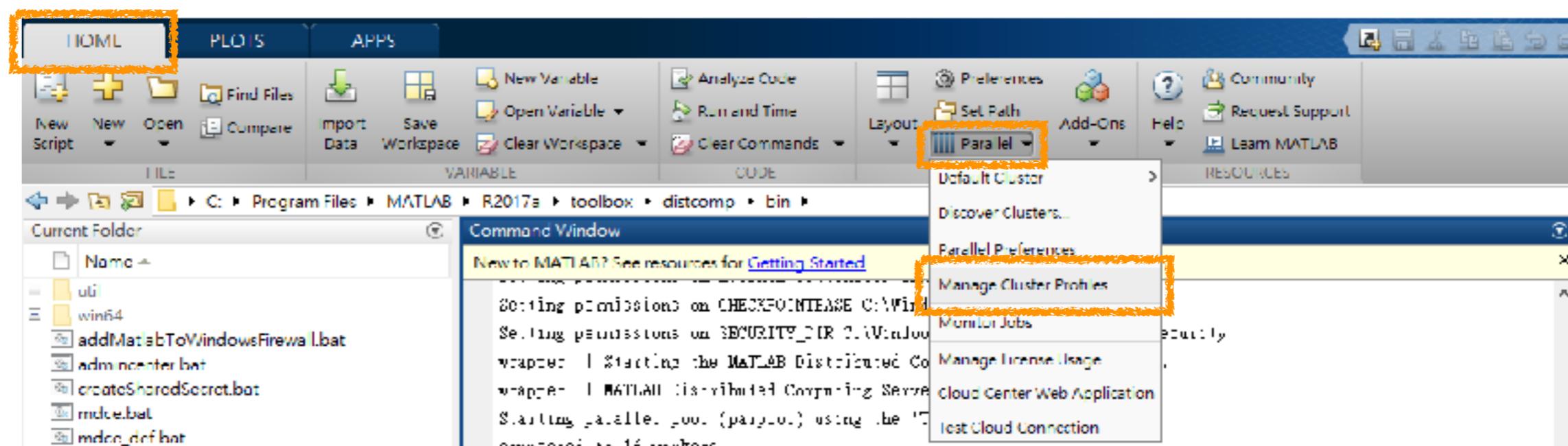
Last updated: 2018/1/6 下午 5:15

Update every 2 minutes Update Now

• 在 MATLAB 啟用 Parallel Computing

- 完成路徑設定以及連接電腦後，回到 MATLAB
- MATLAB 設定

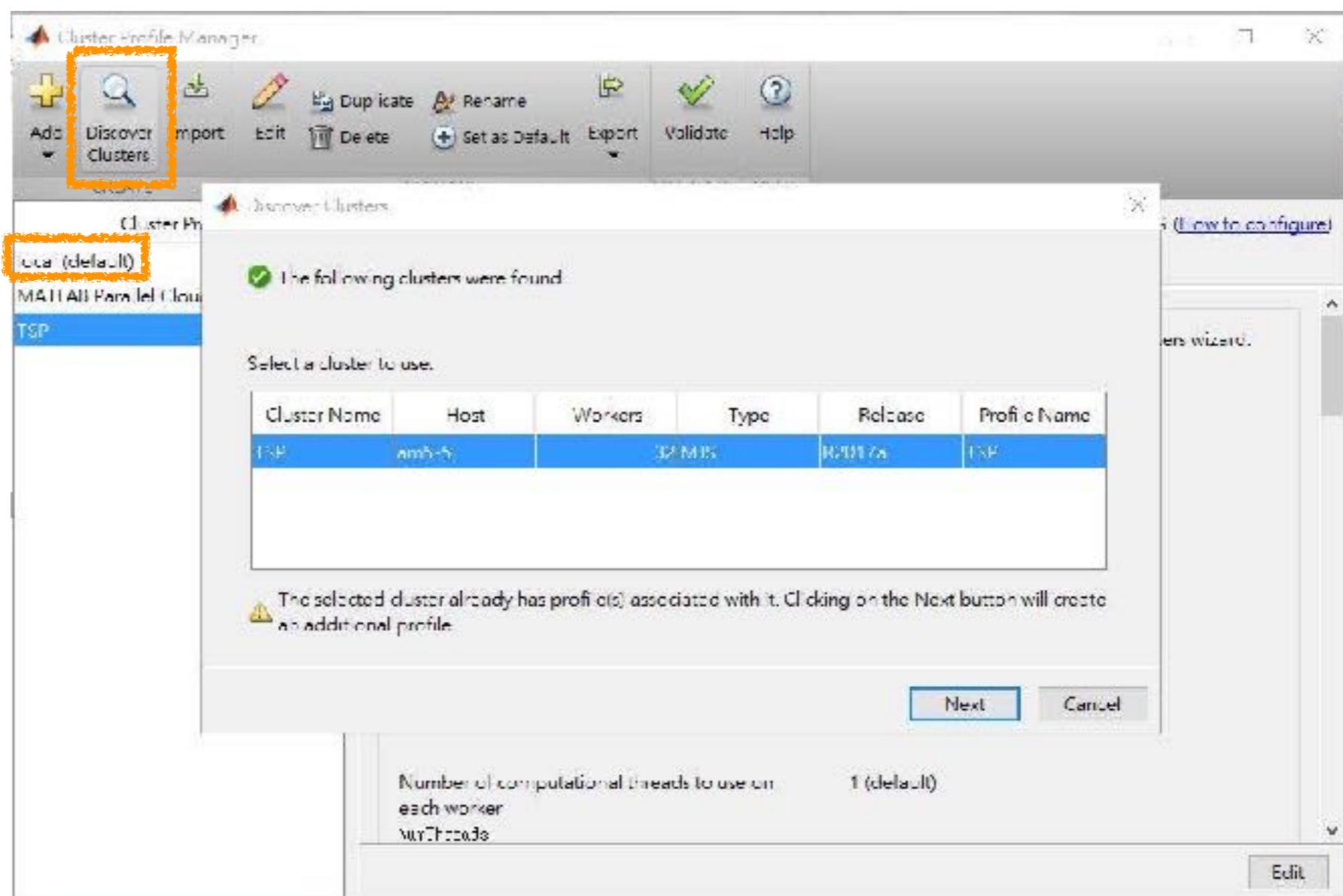
1. 點選 Parallel → Manage Cluster Profiles



• 在 MATLAB 啟用 Parallel Computing

• MATLAB 設定

2. 預設狀況只有 local 所以要點選 **Discover Clusters** 把剛剛建立的 Job 在 Matlab 裡面啟動



• 在 MATLAB 啟用 Parallel Computing

• MATLAB 設定

3. 啟動後要對此 Job 做驗證

The screenshot shows the MATLAB Cluster Profile Manager interface. The 'ISP' profile is selected, and the 'Validation' tab is active. The validation process is complete, with all tests passing. The 'Validate' button is highlighted with a red box and a red '2.' next to it.

Cluster Profile Manager

Cluster Profile: ISP ^{1.} Type: MJS ([How to configure](#))

Properties: Validation

Stage	Status	Description
<input checked="" type="checkbox"/> Cluster connection test (parcluster)	✓ Passed	
<input checked="" type="checkbox"/> Job test (createJob)	✓ Passed	
<input checked="" type="checkbox"/> SPMD job test (createCommunicatingJob)	✓ Passed	Job ran with 32 workers.
<input checked="" type="checkbox"/> Pool job test (createCommunicatingJob)	✓ Passed	Job ran with 32 workers.
<input checked="" type="checkbox"/> Parallel pool test (parpool)	✓ Passed	Parallel pool ran with 32 workers.

Number of workers to use: Use default

STAGE DETAILS

Stage started at ET 06:45:16. Completed in 0 min 0 sec.

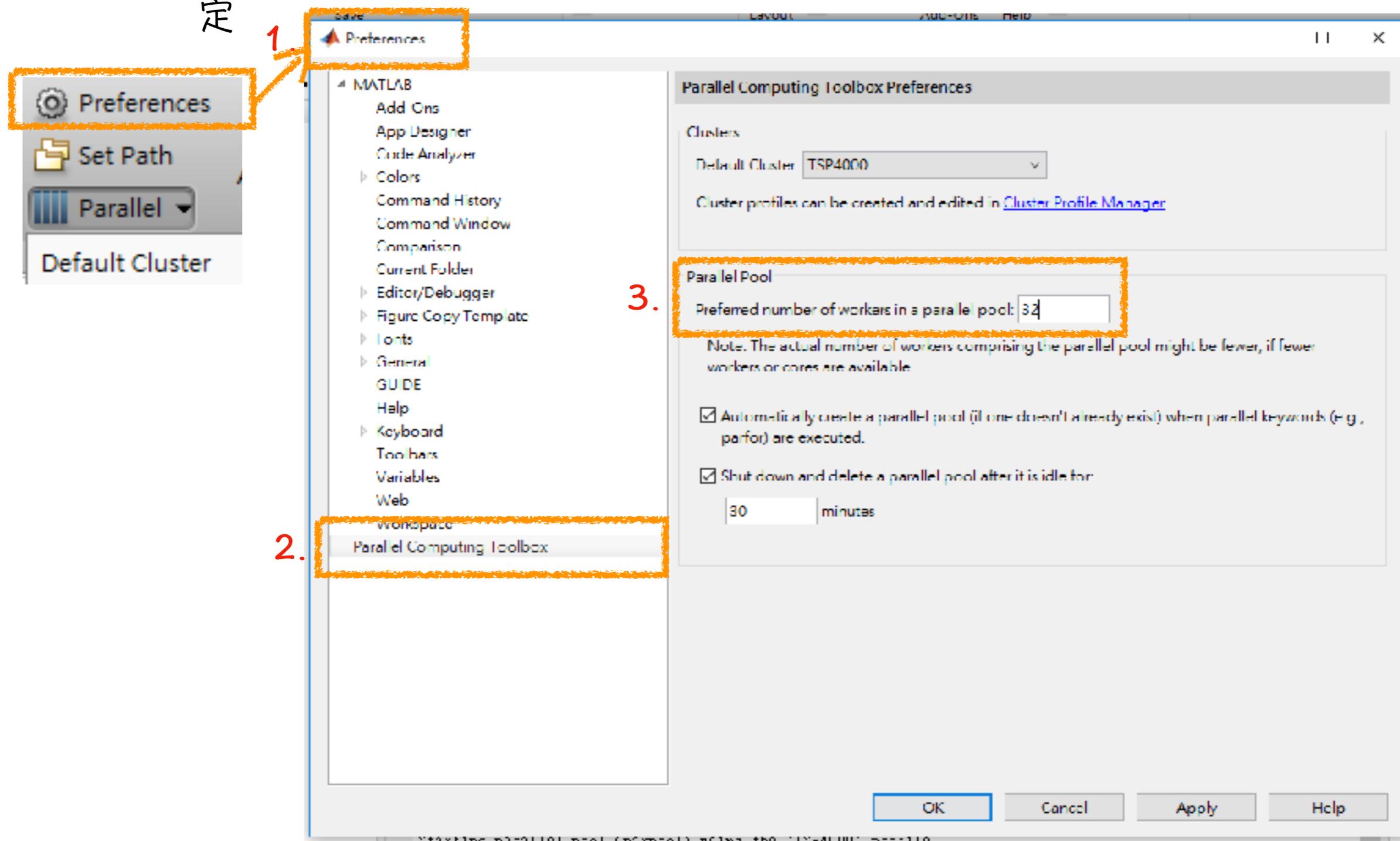
2. Validate Show Report

A >> |

• 在 MATLAB 啟用 Parallel Computing

- 在預設狀況下 Parallel Pool 是 12，這會導致即便連接 32 核心也只能啟動 12 核心，因此我們需要來到 **Preferences → Parallel Computing Toolbox** 調整上限的設定

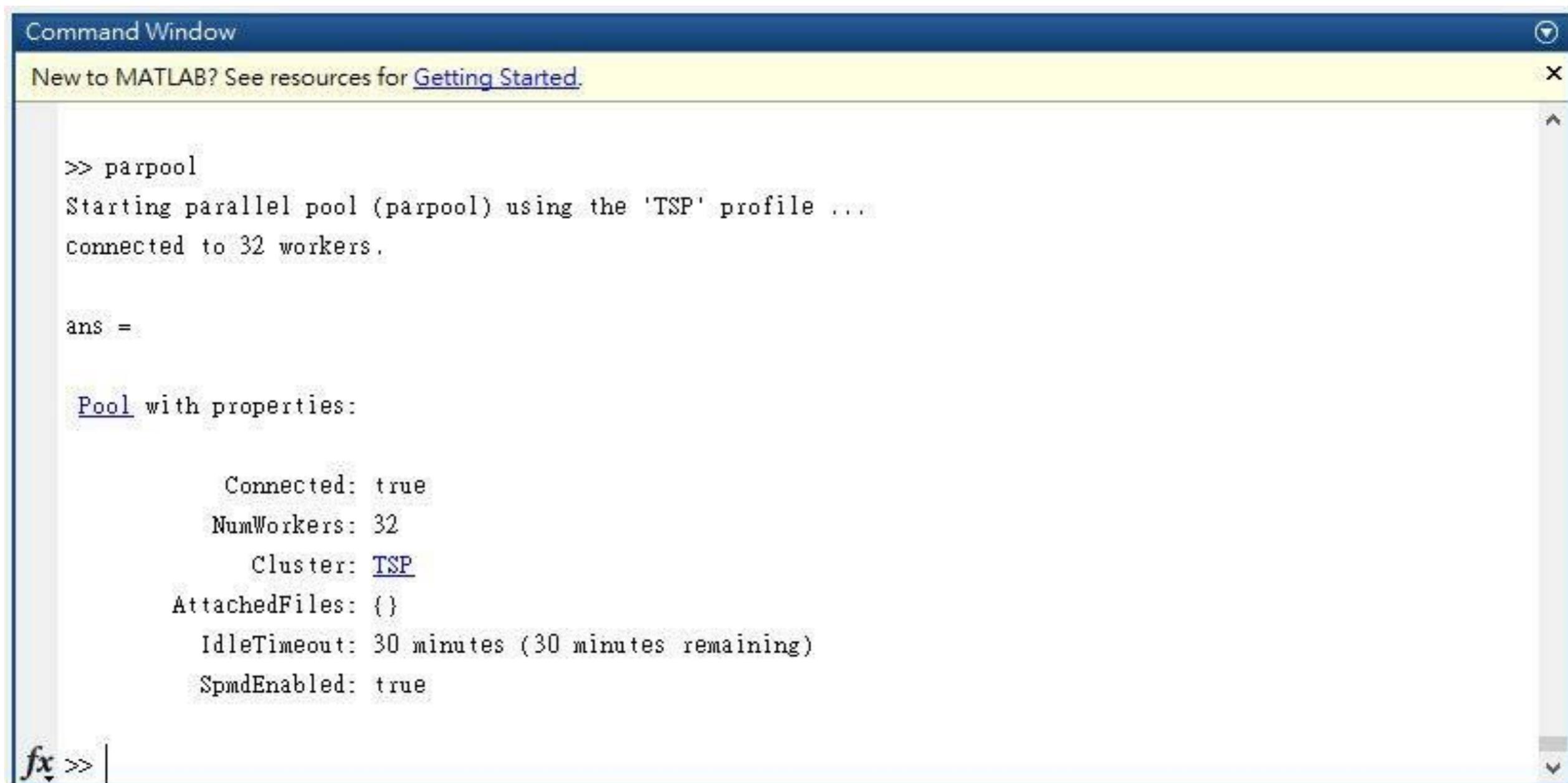
定



fx >> |

• 在 MATLAB 啟用 Parallel Computing

- 在 Command Window 輸入 `parpool` 確認先前所做的所有設定是否完成



```
Command Window
New to MATLAB? See resources for Getting Started.

>> parpool
Starting parallel pool (parpool) using the 'TSP' profile ...
connected to 32 workers.

ans =

Pool with properties:

    Connected: true
  NumWorkers: 32
    Cluster: TSP
AttachedFiles: {}
  IdleTimeout: 30 minutes (30 minutes remaining)
  SpmdEnabled: true

fx >> |
```

• TSP for 4000 cities

START!!!

讓我們現在來實際做個例題吧!!!

Thanks for your listening

107.07.09
Vicky Kuo

