Scrum #2

NCHC X OpenACC X NVIDIA

OpenACC
More Science, Less Programming

2024 NCHC Open Hackathon

Important Dates

- 2024 / 10 / 15 (Tue) ： Registration deadline
- 2024 / 11 / 04~08 ： Connecting Mentors and Teams
  - Slack Channel, Emails Group, Line Group
- 2024 / 11 / 13 (Wed) ： Day 0: Kick-off Meeting 14:00~17:00 PM (Online)
- 2024 / 11 / 20 (Wed) ： Day 1: Scrum #1 Meeting 14:00~15:00 PM (Online)
  - 4-minute presentation per team
- **2024 / 11 / 27 (Wed) ： Day 2: Scrum #2 Meeting 14:00~15:00 PM (Online)**
  - **4-minute presentation per team**
- 2024 / 12 / 04 (Wed) ： Final Day 10:00~16:00 PM (In-person at NCHC)
  - 12-minute presentation + 3-minute Q&A per team

12/04 Final Day Lunchbox and Attendance

https://forms.office.com/r/nP5RbUQLFh

All attendees are required, including mentors, please make sure reply it by this Wed, 11/27, thanks.

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OPEN HACKATHONS
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國家高速網路與計算中心
National Center for High-performance Computing
NVIDIA

Reminder

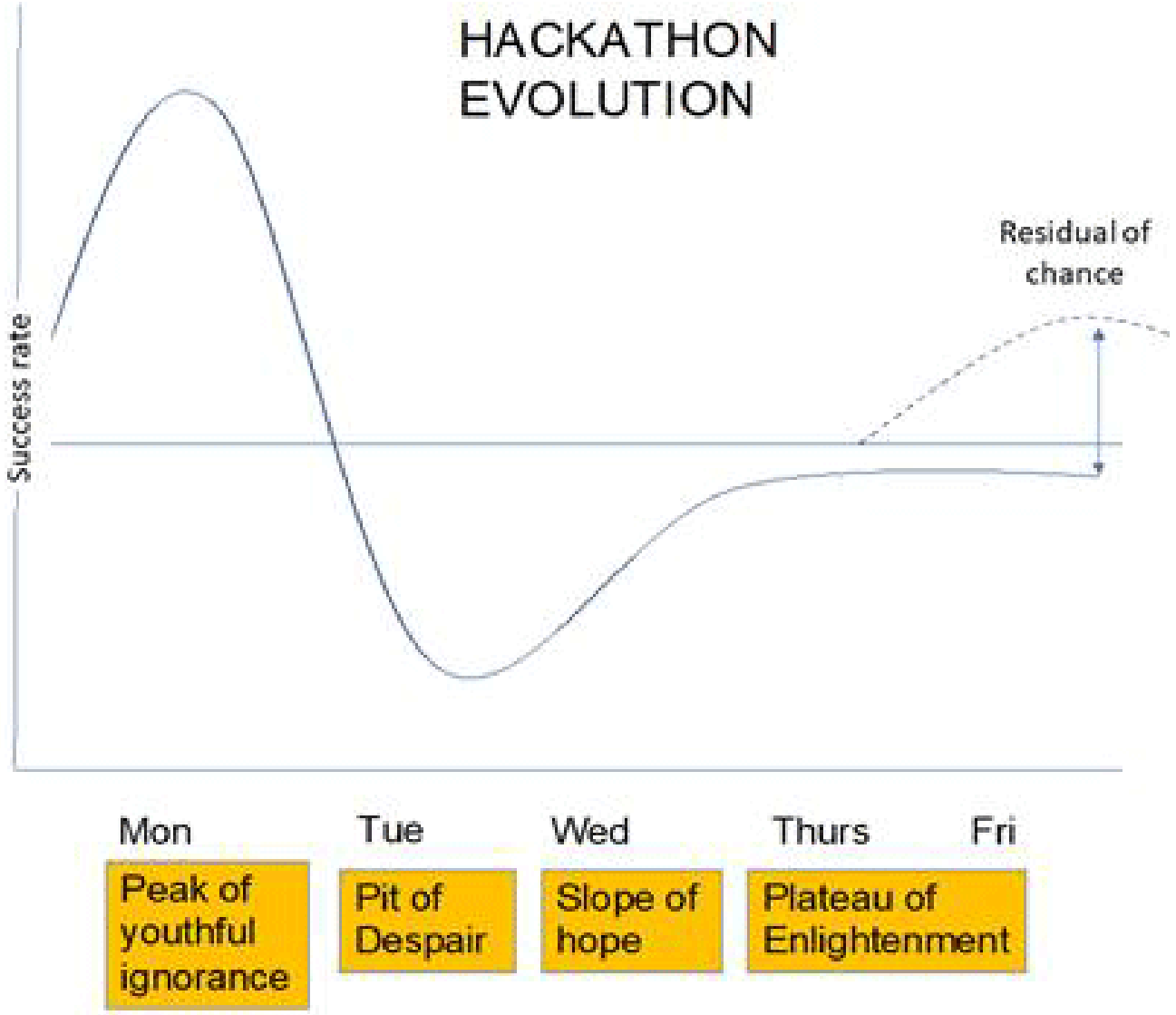
Slack’s free trials will end by Nov 27, **chat history will be lost**.

Your team’s free trial of Slack Pro, our most popular business plan, ends **November 27th**. Upgrade to keep your team running smoothly with these premium features.

Day 2 - Scrum #2 Meeting 14:00~15:00 PM (Online)

4 mins for each team

- #team-1-dream-chaser
- #team-2-nycu-hpc-team2
- #team-3-氣象署-興大應數聯隊
- #team-4-ntut_birdsong
- #team-5-parallel-minds
- #team-6-nthu_lsalab
- #team-7-nolab
- #team-8-elsa-robotics
- #team-9-gba-vvm
- #team-10-smile-lab
- #team-11-plantmen
- #team-12-cycu-quantum



This article highlights the Oak Ridge Leadership Compute Facilitys GPU Hackathon
https://www.computer.org/csdl/magazine/cs/2018/04/mcs2018040095/13rRUxYIN88

Day Final - Template

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Total presentation time is 12 minutes

Team Name

Team Members (Name, organization, and picture)
Team Mentors (Name, organization, and picture)

Application Name

- Problem the team is trying to solve.
- Scientific driver for the chosen algorithm.
- What's the algorithmic motif?
- What parts are you focused on?

Evolution and Strategy

- What was your goal for coming here?
- What was your initial strategy?
- How did this strategy change?

Results and Final Profile

- What were you able to accomplish?
- Did you achieve a speed up?
- Show multi-core vs. GPU numbers
- What did you learn?
- Did you create a new algorithm?
- Did you achieve new scientific goals?

Energy Efficiency

INPUTS	
# CPU Cores	64
# GPUs (A100)	6
Application Speedup	20.0x

Node Replacement	13.3x

GPU NODE POWER SAVINGS			
	AMD Dual Rome 7742	8x A100 80GB SXM4	Power Savings
Compute Power (W)	14,667	6,500	8,167
Networking Power (W)	619	93	526
Total Power (W)	**15,286**	**6,593**	8,693

Node Power efficiency	2.3x

ANNUAL ENERGY SAVINGS PER GPU NODE			
	AMD Dual Rome 7742	8x A100 80GB SXM4	Power Savings
Compute Power (kWh/year)	128,480	56,940	71,540
Networking Power (kWh/year)	5,424	814	4,610
Total Power (kWh/year)	**133,904**	**57,754**	**76,150**

$/kWh	$	0.18
Annual Cost Savings	$	13,707.04
3-year Cost Savings	$	41,121.13

Metric Tons of CO2	54
Gasoline Cars Driven for 1 year	12
Seedlings Trees grown for 10 years	892

(source: Link)

The calculator will compare the consumption of a number of CPU-only nodes with dual CPUs required to perform the same amount of work as 1 GPU node with 2 CPUs and 8 GPUs.

1. Use this calculator for your report
2. Add your acceleration numbers in the INPUTS section
3. Modify $/kwh number if necessary
4. Paste a screenshot similar to the one on the right in this slide to report energy efficiency of your project

What problems have you encountered?

- Problems with legacy app structure.
- Issues with algorithms.
- Tool bugs.
- Tool lacking features.
- System setup.

Wishlist

- What do you wish existed to make your life easier?
- Tools
- Language standards
- Event
- Systems

Final Thoughts

- Was this Open Hackathon worth it?
- Will you continue development?
- Next steps, future plans.
- What sustained resources or support will be critical for your work after the event?

Application Background

High-level description of application and uses.
Light on domain-specific jargon; should be appropriate for a general technical audience.
Targeted computational motifs.

Plot Showing Representative Result

Caption describing figure in simple terms

Hackathon Objectives and Approach

Programming models.
Profiling/hot spots
Refactoring
Libraries
Performance tuning
Other

Technical Accomplishments and Impact

What were you able to achieve at the hackathon?
How did you achieve it?
Speedup
Why does it matter/what does it enable?

(Required) Create a storyline for publication on NCHC's website.

淺顯易懂的標題

研究領域示意圖

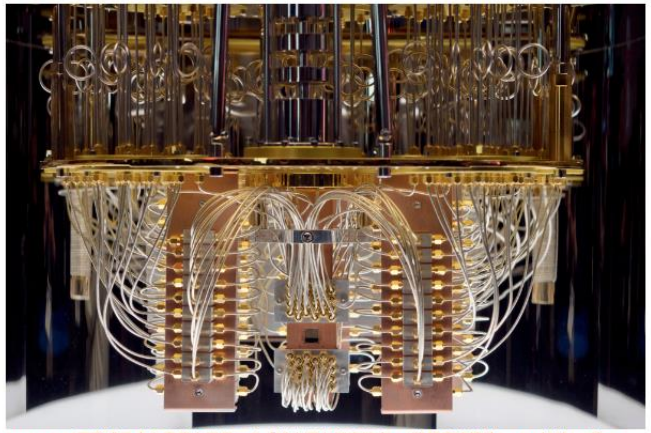
{__} 團隊來自 {__}老師帶領的{__}實驗室,
將 {__} 加速了 {__} 倍！！

250~500 字儘量老嫗能解的描述。
為什麼這個領域重要？為什麼這個命題重要？加速成果？加速帶來什麼影響和潛力？

和加速成果相關的補充數據

報告投影片連結 (由國網上傳到 github)

量子算法模擬



haofan2023團隊成員來自臺灣大學資工系「洪士灝老師實驗室」，將量子演算法QAOA加速468倍！
— NVIDIA Mentors: Tian Zheng, Frank Lin, Yun-Yuan Wang

量子技術正以驚人的速度發展，預示著我們即將進入量子計算的時代。在這個過程中，量子電路模擬成為一個關鍵工具，它在量子硬體和軟體的開發中扮演著重要的角色，特別是在處理量子程式的編寫和驗證方面。傳統電腦的強模擬能夠獲得完整的量子狀態信息。這使得傳統電腦在構建量子系統方面變得不可或缺，尤其是在當前噪聲較多的中等規模量子（NISQ）時代。

量子近似優化算法（QAOA）是一種常用的量子算法，用於通過近似解來解決組合優化問題。然而，在虛擬量子計算機上執行QAOA對於解決需要大規模量子電路模擬的組合優化問題而言，會遇到模擬速度較慢的問題。團隊使用數學優化來壓縮量子操作，並結合有效的位元操作進一步降低計算複雜性，透過GPU加速最高獲取468倍的加速效果！

Table 1: The elapsed time of 5-level QAOA (unit: second, double).

Qubit	CPU_{Single}	$CPU_{Mutiple}$	CPU_{Cache}	GPU_{Cache}	GPU_{All}
23	29.80	1.28 (23x)	1.28 (63x)	0.24 (120x)	0.06 (**341x**)
24	68.00	3.46 (20x)	3.46 (43x)	0.55 (123x)	0.12 (**382x**)
25	152.52	15.32 (10x)	15.31 (45x)	1.19 (127x)	0.23 (**404x**)
26	330.69	33.83 (10x)	33.83 (56x)	2.60 (126x)	0.56 (**417x**)
27	712.26	72.66 (10x)	72.66 (54x)	5.59 (127x)	1.08 (**427x**)
28	1556.87	156.52 (10x)	156.52 (54x)	11.96 (130x)	2.17 (**445x**)
29	3325.55	335.09 (10x)	335.09 (49x)	25.73 (129x)	4.45 (**451x**)
30	7226.46	718.33 (10x)	718.33 (47x)	55.20 (130x)	9.22 (**468x**)

更多資訊請看：https://github.com/nqobu/nvidia/raw/main/20231207/Team02.pdf

2023 Hackathon Stories Examples

https://www.nchc.org.tw/Message/MessageView?id=3874&menutype=0&sitemenuid=5&mid=46

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核心服務 創新技術 科研成果 動態資訊 關於我們

看 OPEN 黑客松如何帶領了技術變革? DPU把網路，GPU把大型語言模型、大氣科學、量子電路模擬，通通加速！

2023.12.07

動態資訊

- 焦點新聞
- 活動專區
- 動態集錦
- 招標公告
- 出版品專區
- 專利/商標與技術移轉
- 影音專區
- 輿情回應

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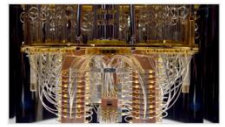
::: > 科研成果 > 學研成果

學研成果

日期 開始日期 ~ 結束日期 關鍵字 關鍵字
ex：2019/01/01



2024.01.30
【2023 NCHC, NVIDIA, OpenACC 黑客松】-HPC、DPU及量子運算加速成果

2024.01.30
【2023 NCHC, NVIDIA, OpenACC 黑客松】-大氣科學應用加速成果

2024.01.30
【2023 NCHC, NVIDIA, OpenACC 黑客松】-人工智慧應用加速成果

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2023 Final Report Examples

https://github.com/nqobu/nvidia/tree/main/20231207

參與團隊

1. Quantum-Inspired Algorithm (QUBO), Schrödinger's cat
2. Quantum Circuit Simulation (QFT, QAOA), haofan2023
3. 5G SBA (Service Based Architecture), NTHU-LSALAB
4. 3D-CFD (Direct Forcing Immersed Boundary, LES turbulence model), NTUST CFD Lab
5. Mesh Generation for MPAS Model, CWA mesh generation
6. A.I. in Otoscopic Diagnosis, CYCU BME
7. Global Ensemble model Verification, CWA_GVER
8. Arrhythmia Screening of Real-Time Single-Lead ECG, WTMH
9. CWAGFS-TCo - Numerical Weather Prediction Model, 氣象署-興大應數聯隊
10. Accelerate Encrypt/Decrypt Operation in Functional Encryption, YSS Team
11. X-ray Background Correction Model, TXM AI Group
12. LLM Inference with TensorRT-LLM on NCHC servers, NCHC Speedrunning Team


Thank You
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