Welcome to Our Lab

Message & Information from Wen Sheng Lim (林文盛)

About Research

Our Focus

- We focus on computer systems research
- We discuss why and/or how
  - software (e.g., services, applications, processes, etc.)
  - executed on hardware (e.g., memories, storages, etc.) behave like it shows
  - from a fundamental perspective (e.g., operating system, device firmware, etc.)
- Recently, there are ultra-low latency devices and new hardware technologies from Macronix

What is a System?

- System = Mechanisms + Policies
  - Mechanisms are tools (what is that), e.g., architecture, system model, data structure, etc.
  - Policies are methods (how to use), strategy, algorithm, parameter, etc.
- Note that they are a combination

Our/Your Expectation

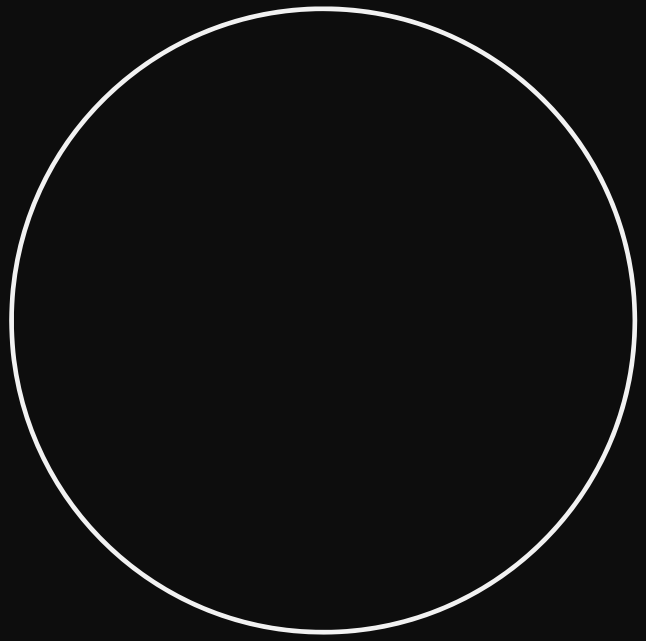
- You should/can learn to think in your graduation life
  - Its all about critical thinking: justify and defense for your work, though and everything
  - Top-down thinking is what you need: think and tell anyone anything fast, clear and accurate (like a boss)
- 原豪的隨手雜記 -【豪豪老實說】 Johnson's Notebook - Johnson Being Honest

What is Research?

- “Research is a repeat search process to know unknown”

What is a Research?

Imagine a circle that contains all of human knowledge



What is a Research?

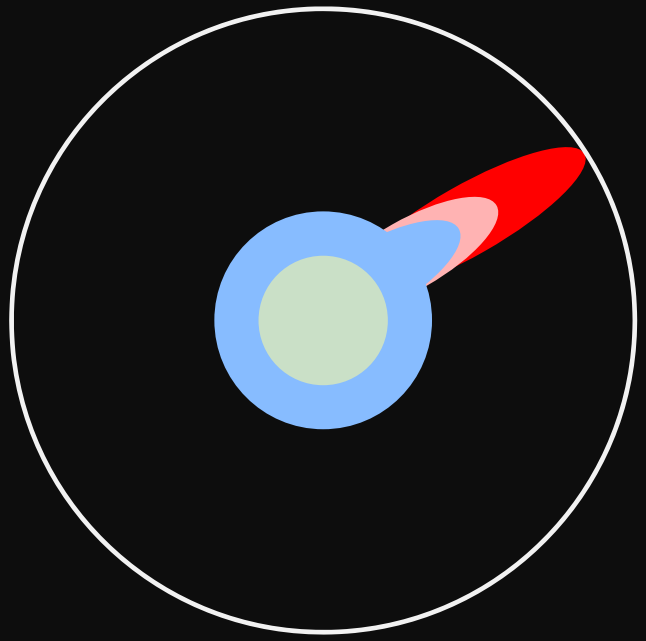
After the high school education and bachelor's degree

What is a Research?

A master's degree deepens that specialty

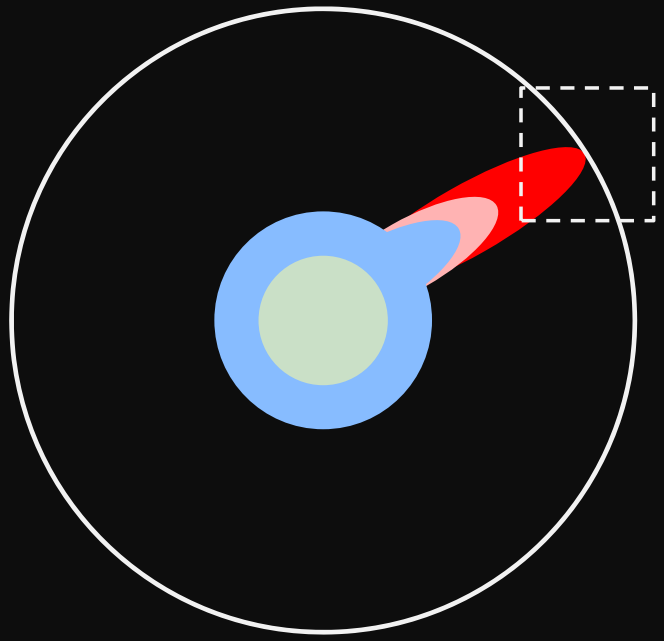
What is a Research?

Reading papers takes you to the edge of human knowledge



What is a Research?

Once you're at the boundary, you focus

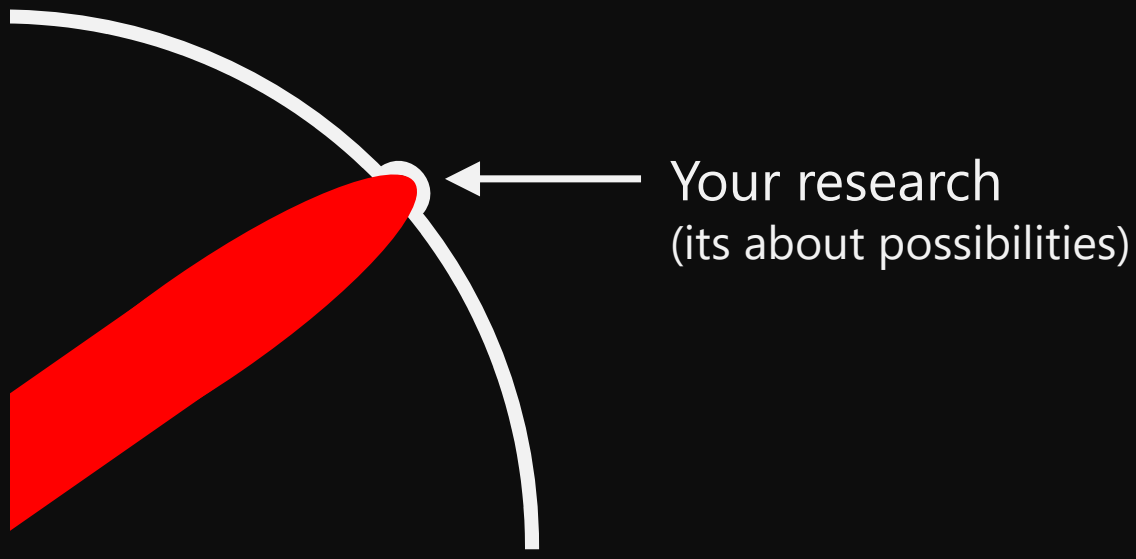


What is a Research?

You push at the boundary for a few years

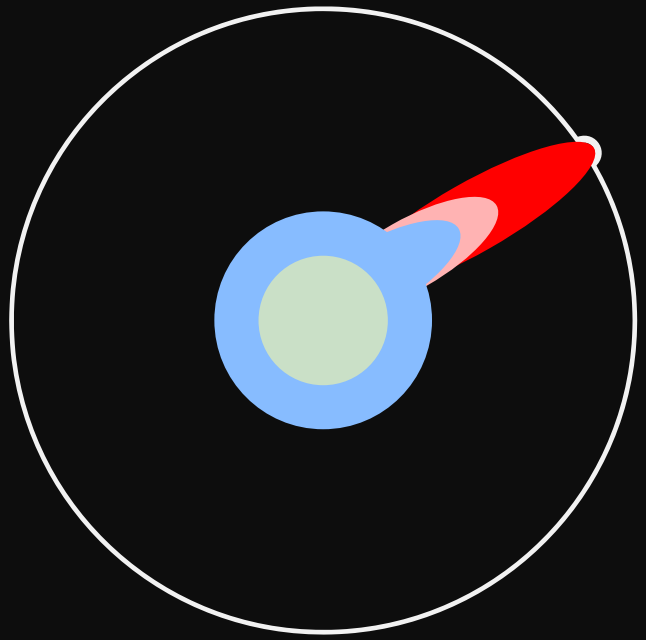
What is a Research?

Until one day, the boundary gives way



What is a Research?

The world looks different now

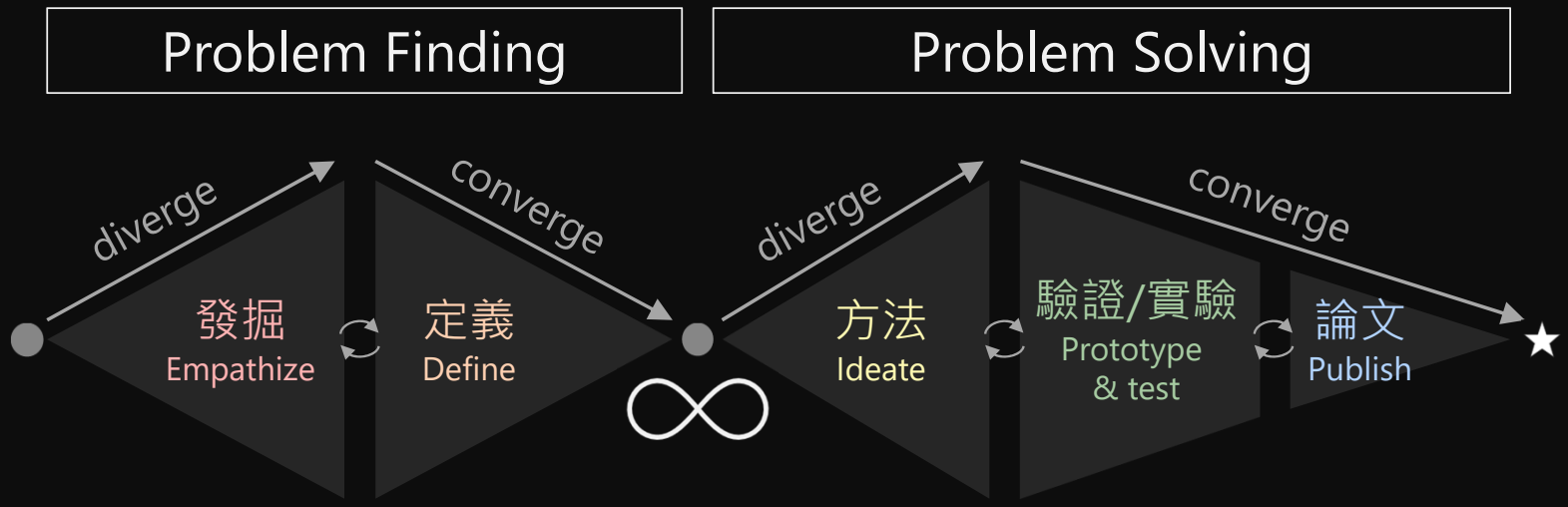


A Tacky Metaphor (My Personal Though…)

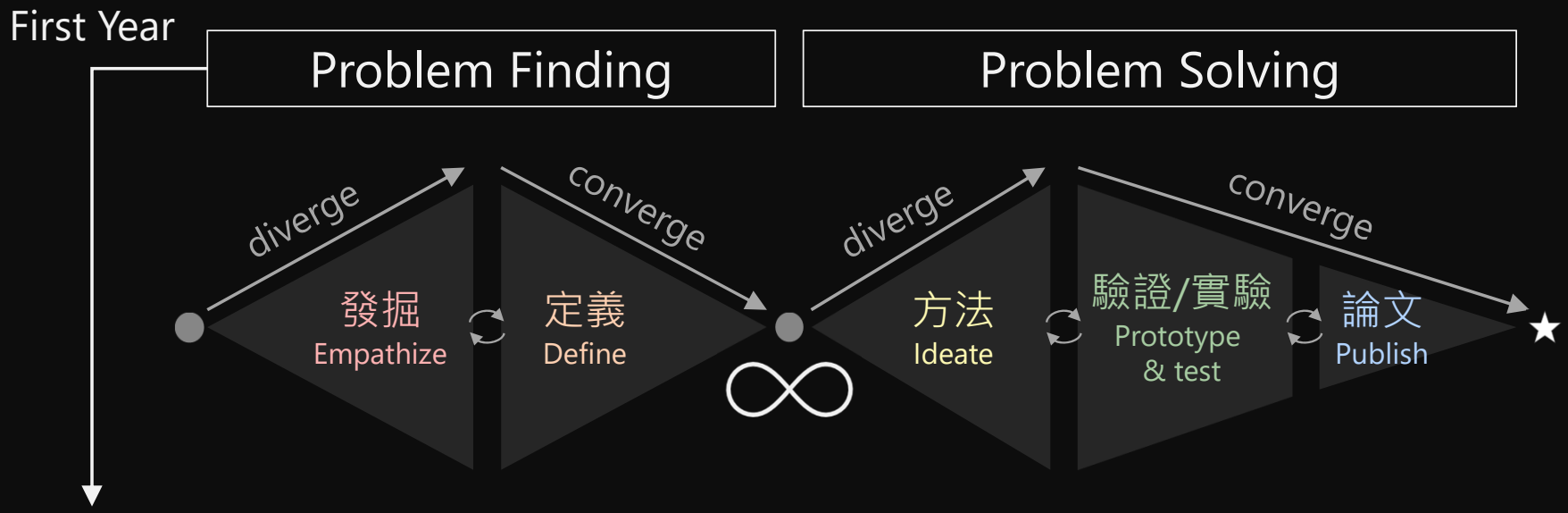
- Academic research is like…
  - “直銷” and “傳銷”
  - “保健品” and “藥品”
  - “救自己” and “救人救世界”

- You can learn the former in your Master/Ph.D., but it is your responsibilities to make a step forward to the latter

How to Research?

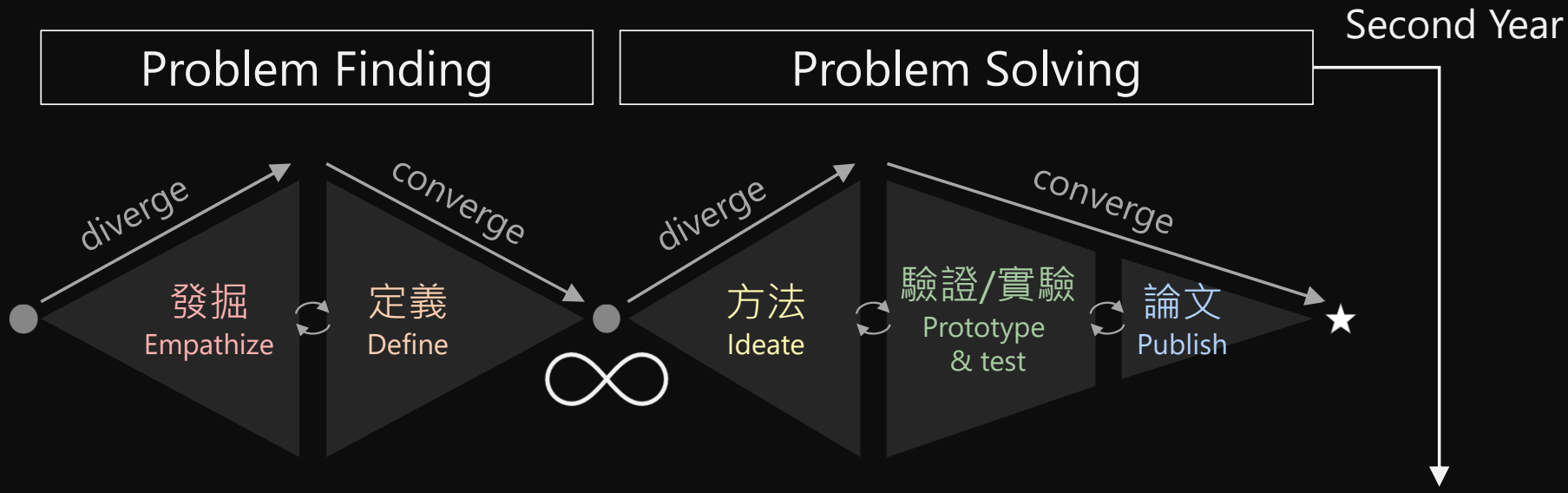


How to Research?



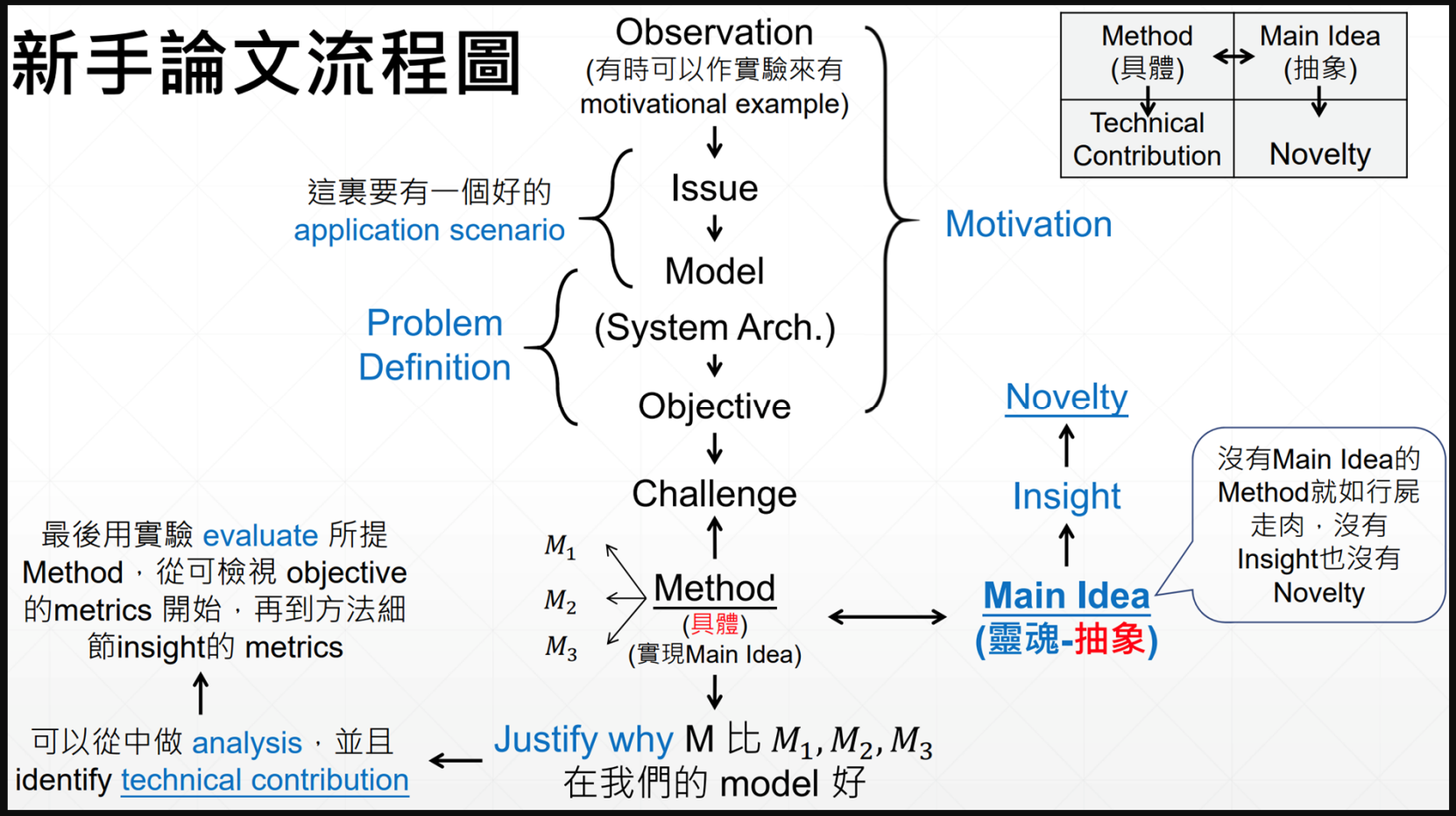
- You will read a lot of research papers
- You justify your finding (problem) a “right on the edge” with a clear definition

How to Research?

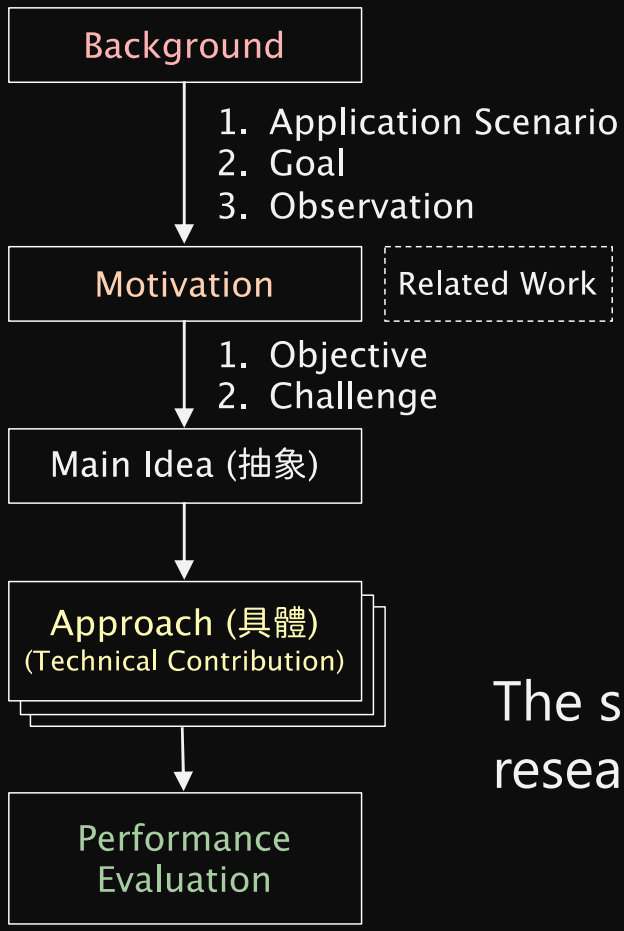


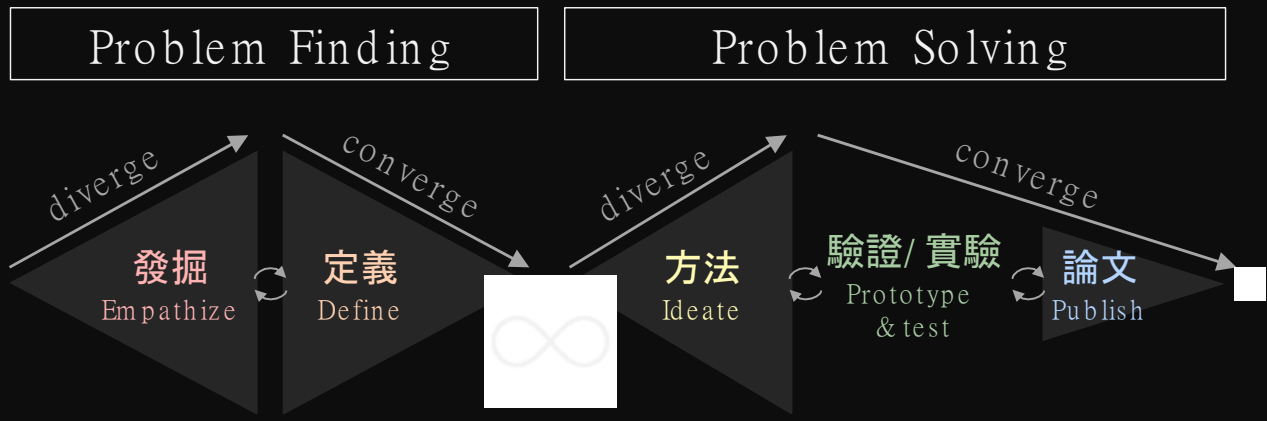
- You find and justify (by telling and doing experiment) they way to solve your problem
- You write it down and publish it to (change) the world

A completed research may look like...



Let's Make It Simple





The simplest way to make sure you understand a (your) research is to summarize it into these five points

What is a Good Research?

Strong Motivation

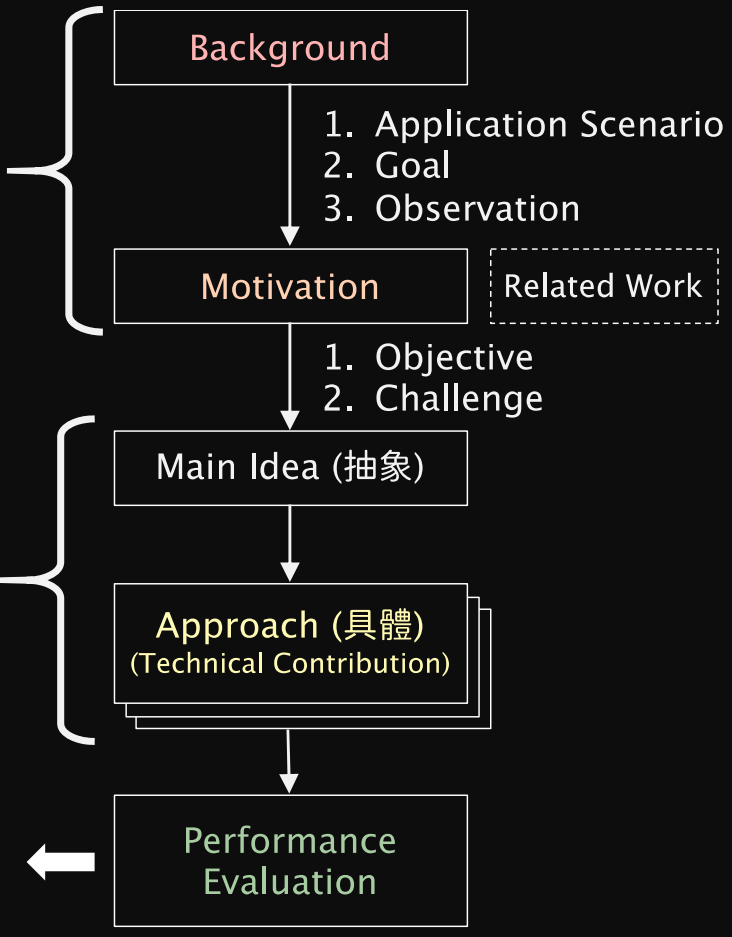
to convince people your problem is so important

Novel Approach

to convince people your answer is so good

Completed Experiment

to convince people your problem and your answer is so true in every dimensions



How to do a Good Research?

- The art of asking: Ask “why so” and “so what”

About Your Graduation

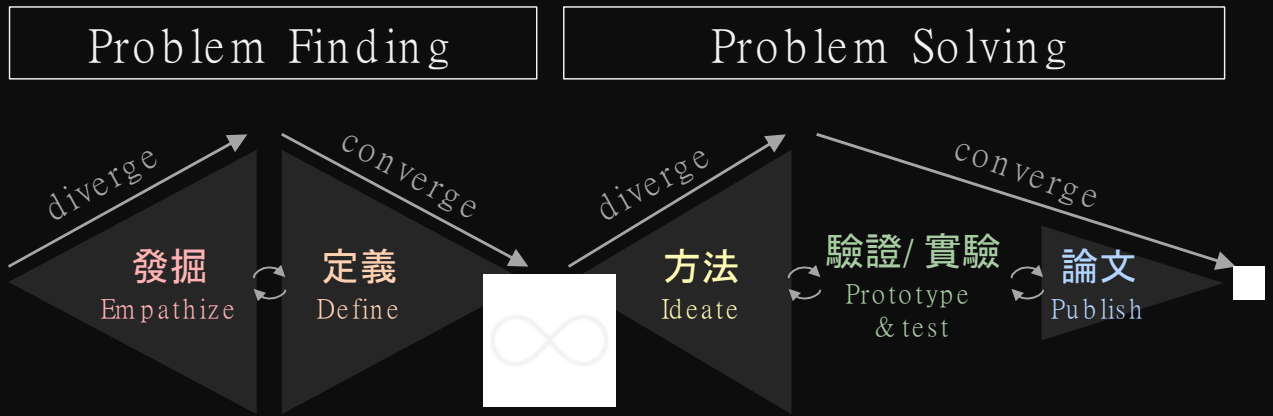
Guides for Your Graduation

- One approved (by Prof. Kuo) research for Master students and three for PhD students
- Justify your research in oral defense (late June to early July) with presentation slides
- Write then down in English (i.e., thesis)

- Your work will be (must) submitted to conference and/or journal, you have the responsibility to finish it. Please discuss with your senior PhD student after graduate

Checkpoint for Your Graduation

- Usually, each block below takes one semester to complete
- Start writing your thesis after oral defense is okay
- Summer break is important for you to revise your location (e.g., is your progress fine? or you have to speedup?)



It is Important to Note that…

- You are not here to learn knowledge (i.e., take courses, do project, internship, etc.)
- You should have the ability to learn yourself as an undergraduate student (also, an adult)

- Your progress is everything!
- Take your own risks!

Meetings and Presentations

About Meetings (1/2)

- Twice a week
- First with Prof. Yuan-Hao Chang (張原豪)
  - Date and Time: TBD
  - Location: Academia Sinica, 6th floor (wait in room 606)
- Last with Prof. Tei-Wei Kuo (郭大維)
  - Date and Time: Monday and Thursday (1930 to 2130 for online; 0900 to 1200 for offline)
  - Location: Online via Google Meet; Offline in room 404
  - Prof. Kuo will notice the date and time every week before meeting via email (you should be added into the mailing list)

About Meetings (2/2)

- Differences between these two meetings
  - Prof. Kuo guides and advises for your research direction to avoid you go astray
  - Prof. Chang discuss with you in detail (to justify your work against Prof. Kuo)
  - Senior PhD students help you in everything (Every newbies may have a senior student to lead them in researching)

About Presentations

- Prepare presentation slides when meeting (10 minutes with Prof. Kuo and 20 minutes with Prof. Chang)
- Guide for presentation
  - (before) Think why and what you want to present or discuss
  - Tell clearly why and what you want to present or discuss
  - Go directly to the point (you have only 10 minutes to attract someone)
  - Take note for every feedback and think about it
  - (after) Discuss with your senior PhD immediately or with Prof. Chang in next meeting
  - (other) Knowing where you are in your research path is very important, please ask if you loss yourself

Useful Sites, Tools and Tips

Paper Searching (1/4)

- Google Scholar is the easiest way to find a paper with keywords
  - Subscribe the sources of your research direction to keep track on your research (authors, citation, related articles)

- DBLP is a useful site to search paper written from someone and paper published in specific conferences, journals and transactions
  - For the latest conference papers, official sites may be a good choice

Paper Searching (2/4)

- Tips to search papers of specific research area
  - Keywords
  - Authors (i.e., advisor) from the same research group
  - References
  - Citations (via Google Scholar)

- Tips to start or search for a new research direction
  - Survey and introduction paper
  - “Sources” paper (i.e., all related papers should have to cite them)

Paper Searching (3/4)

- Good paper often publish in good conferences, journals and transactions
  - CSRankings list most top tier conferences
  - Search the conference in Conference Ranks
  - Impact Factor of journals and transactions
- Find our targeted conferences (and deadline) in here
- Paper can be downloaded in NTU Domain (e.g., ACM and IEEE); USENIX's and ArXiv's paper is free to access.

Paper Searching (4/4)

- Connected Paper is a strong sites to get fast overview (Limited in 3 searches for each month)

Paper Reading

- Paper are written in a standardized format. Here are some tips for you …

- Before and after you read paper
  - Think why and what you want from the paper before you read it (when you are in your research stage)
  - Think if this paper is still fit your thought

Paper Presentation (1/2)

- Paper title, author list, affiliations, paper source (where and when the paper published) in the first page
- Useful rules for presentation
  - One idea per page (it should fit to your title)
  - Use bullet to clearly present your idea (not exceed three bullet)
  - Avoid long sentence
  - Illustrate your idea with figures
  - Logical link between bullet and figures (from top to bottom, from left to right)

Paper Presentation (2/2)

- Try to extract the motivation and main idea of the paper and present it out (in few sentences)
  - This is why you are assigned to read a paper
  - Don’t over focus on the technical and experiment staff (don’t follow, think)
- Try to provide your own comment
  - How to you think about this paper?
  - What are the strengths and weaknesses?
  - Is there any inspiration between this paper and your direction?
  - etc.

Paper Writing

- Thesaurus.com is useful when you need to change the word(s) you used to avoid the frequently occurrences of the same word
- You may want to know the meaning of the word you use
  - Cambridge dictionary
  - Oxford advanced learner's dictionary
  - Collins cobuild dictionary
- Grammarly is good for grammar checking (NTU has free premium account)

Paper Naming

- Acronymify is useful to find a fancy acronyms for your work

Paper Everything

- Please don’t let Generative AI (e.g., ChatGPT) limit you
- It can help, but it can’t always help, especially you are “researching”, not “learning”
- Think before and after use it

Some Personal Opinions

Think, Ask, and Discuss

- Don’t believe anything that you have been told (from me, professor, or anyone)
- Please think yourself
- Please ask and discuss with someone

- Tips: keep asking yourself “why so” and “so what”

Care about Yourself

- Your personal life (health, family, etc.) should have the first priority, after this...
  - Research work for your thesis
  - Lab affairs
  - Courses
  - ...

Relax, Enjoy and Have Fun

- Master students can mostly graduate within 2 years (no exception until now)
- This might be the most valuable experiences in your life
- So, just relax, enjoy and have fun in your graduation life

Any Question?

References

- 原豪的隨手雜記 -【豪豪老實說】 Johnson's Notebook - Johnson Being Honest
- Research Skills: From Area Selection to Paper Presentation, from Prof. Pi-Cheng Hsiu
- The illustrated guide to a Ph.D.
- etc.

Lab Affairs

Except for Researching…

- You are responsible to handle some lab affairs
  - Lab events, facilities (reimbursement), network/server management, etc.
- You are responsible to help professor for some irregular/uncertain work assignment
  - …

Discussions

Discussions

- Please make sure all of you are added into all necessary groups (not sure how many are there…)
- Move chat group to line to have better management and information notification (any idea?)
- Build contact information with address book (phone, mail, etc.)
- About facilities (seat, computer, screen, etc.)
- Seat and lab cleaning
- Any things?

About Your Oral Defense

About the Oral Defense

- 30+20 minutes for master and Ph.D. proposal; 60+30 minutes for Ph.D. oral defense
- 1 page ≈ 1 minute, e.g., ~30 pages for master oral defense
- We have templates from previous students. Please “refer” but don’t copy
- Please think and ask yourself “why so” and “so what”, i.e., for every title, figure, words in every pages
- Use 16:9 instead of 4:3

- When you should/can start
  - You are recommended to prepare your slides when your methods are ready to be challenged
  - Please ask and discuss with your advisor (and your Ph.D. senior) if you are ready
- How to prepare
  - Follow and refer to the SOP in the following slides
- After finish your presentation
  - Ask someone (e.g., probably your Ph.D. senior) to help you rehearsal your slide and oral presentation
  - Reserve a few days to fully memorize and practice for your speaking (and check for the time limit)

The First and the Only Thing

The nature of presentation is selling, so…

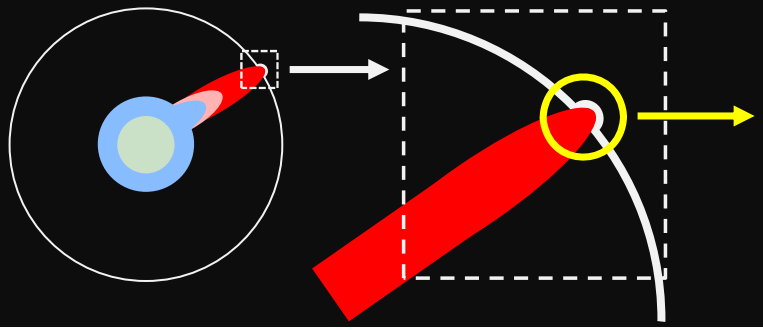
- Make sure you have your title (product), then all you need is to convince the audiences it is so important to the world (i.e., when, what, where, why, how)

they are professors that told to let you pass your oral defense…

- Make sure you know who are the audiences (i.e., what they know, how they think and what they care about)

and they care about how you sell your garbage…

Believe in your work, even it seems (actually it is…) a dust to the world



Tell when, what, where, why and how your "research" is important, and what your have done to make this happen

Follow These Steps

1. Write down the title in every pages (i.e., what you want to present in every pages)
   - The title should have its meaning (e.g., introduction vs. introduction the XXX)
2. Write down one key point for each page (i.e., how you present what you want to present in this page)
3. Draw and/or choose brief figures that can present your key point in the first sight
4. Extend your key point (in 2) to several contents (bullets)
5. Discuss with your advisor (and senior Ph.D. student)
6. Repeat all these steps until they are completed

P.S. Don't make each iteration too long, you can't make it perfect in single iteration

Some Principles

- For each page (and layout):
  - One purpose with at most three contents (sentences) and at most two layers of bullets
  - Top-to-bottom; left-to-right; major-to-minor
  - Use color and typesetting to attract attention (No **MORE** *than* 3!)
  - Consistency and alignment for everything
- For the figure:
  - Use PowerPoint (and store your exp's raw data in excel)
  - Top-to-bottom; left-to-right
  - Don't use animation (or many pages to show something)
  - Use number and arrow to lead the attention

Example of Figures

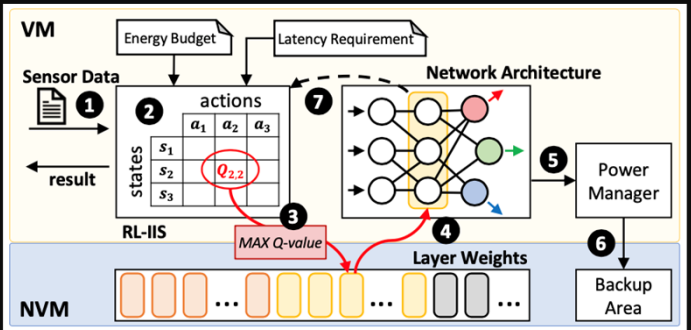


Fig. 5. Workflow of the TRAIN framework.

TRAIN: A Reinforcement Learning Based Timing-Aware Neural Inference on Intermittent Systems, ICCAD 2023

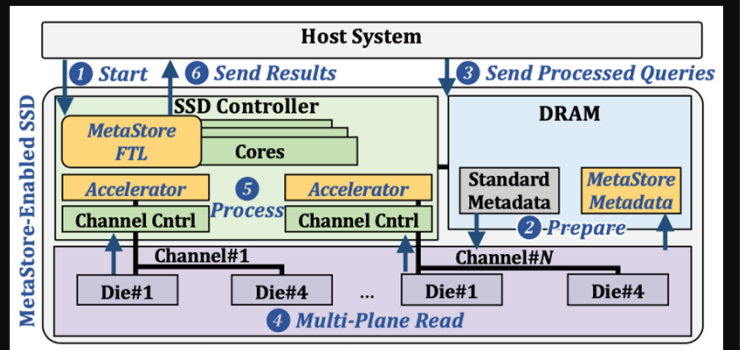


Fig. 3: Overview of MetaStore.

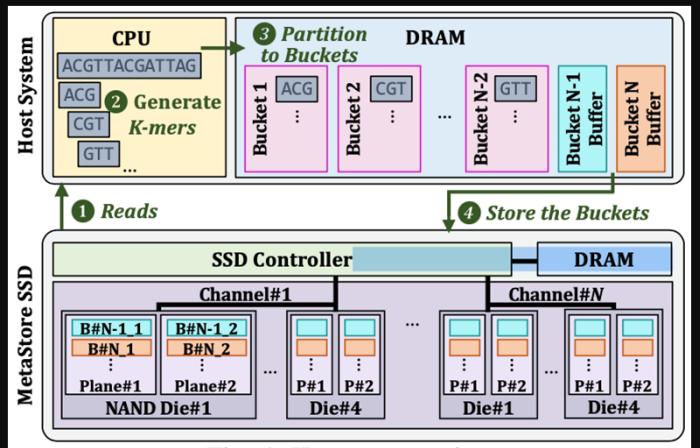


Fig. 4: K-mer generation.

MetaStore: Enabling High-Performance In-Storage Processing for Metagenomic Analysis, MICRO 2023

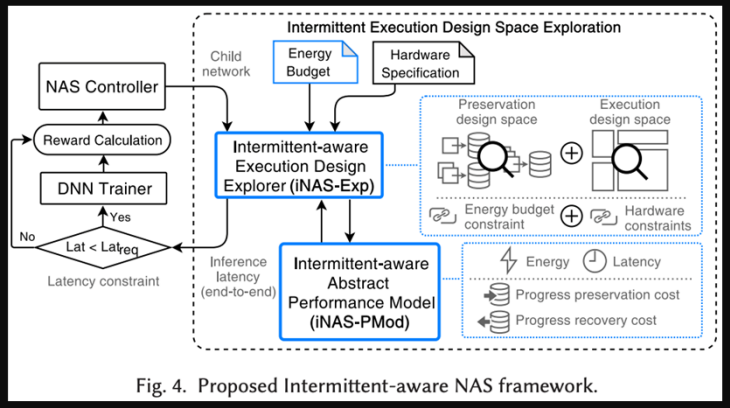


Fig. 4. Proposed Intermittent-aware NAS framework.

Intermittent-Aware Neural Architecture Search, CODES+ISSS 2021

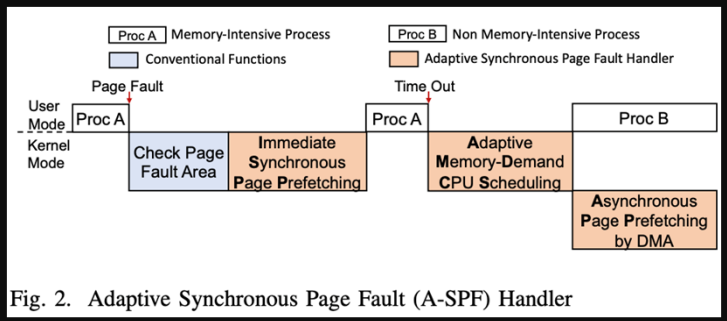


Fig. 2. Adaptive Synchronous Page Fault (A-SPF) Handler

Exploring Synchronous Page Fault Handling, CODES+ISSS 2021

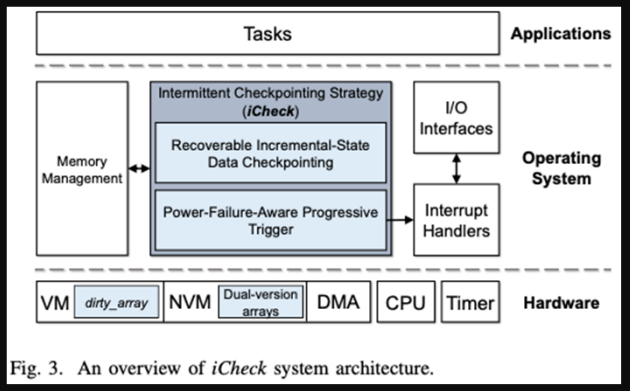


Fig. 3. An overview of *iCheck* system architecture.

iCheck: Progressive Checkpointing for Intermittent Systems, TCAD 2020

Template (1): Introduction

- Use the first page to tell the trends and show the importance (why) of your target domain (what and where) is so important now and still in the future
- Use the following pages to
  - Tell the challenge of the target domain (i.e., the first page)
  - Tell your application scenarios (i.e., to specify and frame your "battlefield")
  - Tell the goal (e.g., performance, reliability, security, …) of your defined scenario

Template (2): Background and Related Works

- Tell the necessary background (one page for one background)
  - Necessary means the audience cannot know how important your work is without them
  - Usually, we assume the audience have CS undergraduate level (you can skip all of these knowledges, or put it in backup slides)
- Show the similar approaches proposed to tackle the same problem (in your battlefield)
  - Conclude why they are not good enough at the end
  - You are expected to compare your work against the related works in performance evaluation (unless you are the only one in the field)

Template (3): Motivation

- Show the reason (usually based on observations) why they not good enough (i.e., how you find the problem)
  - Motivational experiments are highly recommended to show how strong your motivation is
  - Motivational examples are acceptable if the reason is very simple and easy to understand
  - It is okay if you want to provide both of them
- Conclude and tell your problem again, e.g.,
  - Problem, objective, equation, performance metric, etc.
  - Finally, tell the challenges to solve this problem (to show how difficult it is and how smart/novel you approaches are)

Template (4): Approach

- Use one page to give an overview (main idea) of your approaches to show the novelty of your idea
  - An overview on system architecture, or/and the workflow of your approaches is highly recommended
  - The audiences MUST know how you solve the problem in this page with this figure (in high level thought)
  - This should be the most important page in your presentation
- Use the following pages to give the detailed information of your approaches
  - How and why the idea is working, the techniques we use, the assumptions, etc.

Template (5.1): Performance Evaluation

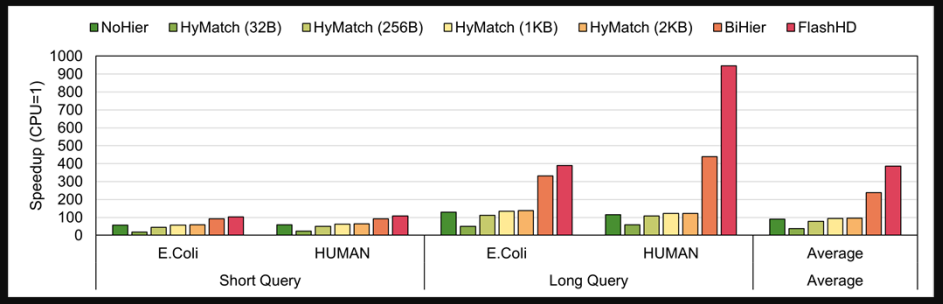
- Show the experimental setup
  - What are the experimental platform (and configurations)
  - What performance metrics you are going to use (to show you are the best)
  - Which state-of-the-arts you are going to compare with
  - What configurations/parameters (if any) of your methods

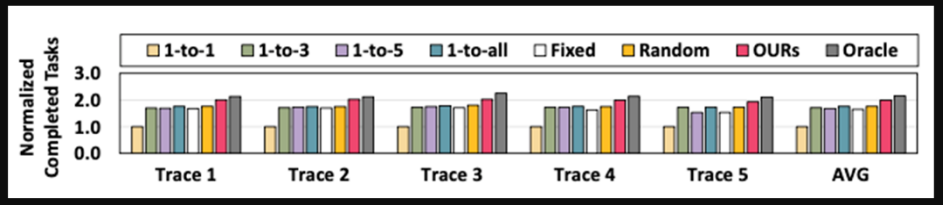
Template (5.2): Performance Evaluation

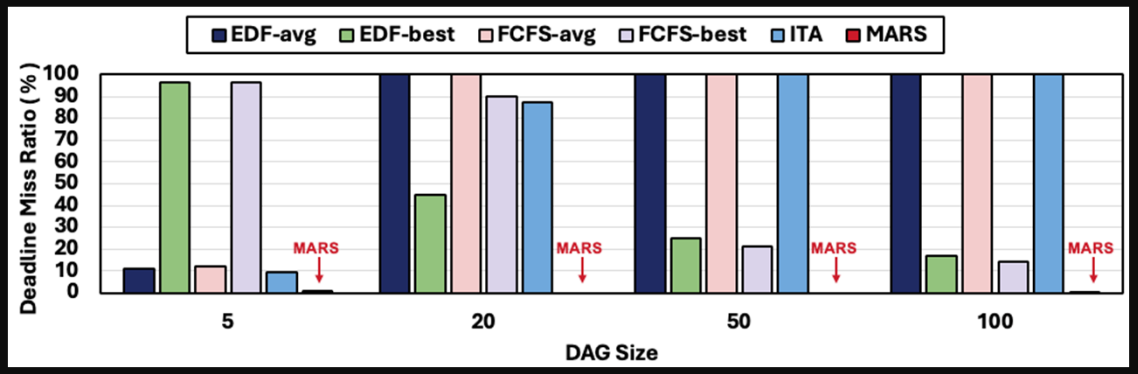
- Show the experimental result (one result each page)
  - Always show your effectiveness on the GOAL first (the result should be presented as simple as possible)
  - Then, show how and why you can achieve your goal (e.g., a breakdown chart, timeline, etc.)
  - Last, show your approach can be used in as much scenario as possible (e.g., overhead, flexibility, scalability, reliability, etc.)
- A performance evaluation is completely considered if it is able to defense your novel approach is useful in all dimension (in your battlefield)

Template (5.3): Performance Evaluation

- Here are some examples to make your result like a “pro”
  - Use border for the bar, frame and label outline
  - Use colors and patterns for different methods (red for ours)







Template (6): Conclusion

- The purpose is to help the audiences to recap that your work (the problem) is strongly motivated, and you proposes a novel approach (the main idea) to solve it and prove it (result) is working in all dimension
  - Sometime, the conclusion includes some addition observations from your experiments
  - You can also have some discussions about your researches and the future works before and after the conclusion, respectively

Some Tips for Preparing Oral Defense

- The oral examination committee will always ask you:
  - The fairness and completeness of performance evaluation (i.e., why your experimental setup, the chosen baseline and workload is representative to your work in all dimension)
  - The scalability, flexibility, adaptivity, extensibility of your work (to other applications or scenario)
  - The time, space (memory and storage), energy, and area overhead of your work
- Spend most of the time to clarify your motivation, problem (definition) and main idea to solve the problem

Some Tips and References

- Be creative; Template and SOP is always the baseline
- A good presentation example you can learn is the course of data-centric computing and in-memory computing presented in Real-Time Systems (by Prof. Tei-Wei Kuo)
  - Data-Centric Computing (update later or you can text me)
  - In-Memory Computing (update later or you can text me)
- For your references (they can be found in 原豪的隨手雜記)
  - How to Compose Premium Quality Figures for Academic Publications, by Prof. Po-Chun Huang
  - 新手論文製圖重點提醒, from Prof. Chien-Chung Ho

About Your Thesis

i.e., after you pass your oral defense (for NTU students)

After Oral Defense

- Note and summarize all the questions and suggestions from the oral committees
- You are expected to fix all of them and include them in your thesis before you officially graduated
  - Discuss with your prof. and Ph.D. senior about the problems and suggestions
  - In this stage, your target is to let your paper accepted by a conference, in which your audiences are reading your research work (but not watching your slides, reading your documents while listening to your presentation); It is much harder!

For NTU Students

(i.e., the thesis is needed only after oral defense)

- Please convert your research work from presentation slide to paper style (i..e, overleaf) with
  - ACM and IEEE conferences template (according to the target conference, if any)
  - Double columns in with font size of 9 or 10
- Why? This help to provide a high-level overview
  - for us to easily judge if a paper is qualified
  - for you to easily write your thesis in a correct way
- Why not thesis template? It is unreadable!!!

For NTU Students

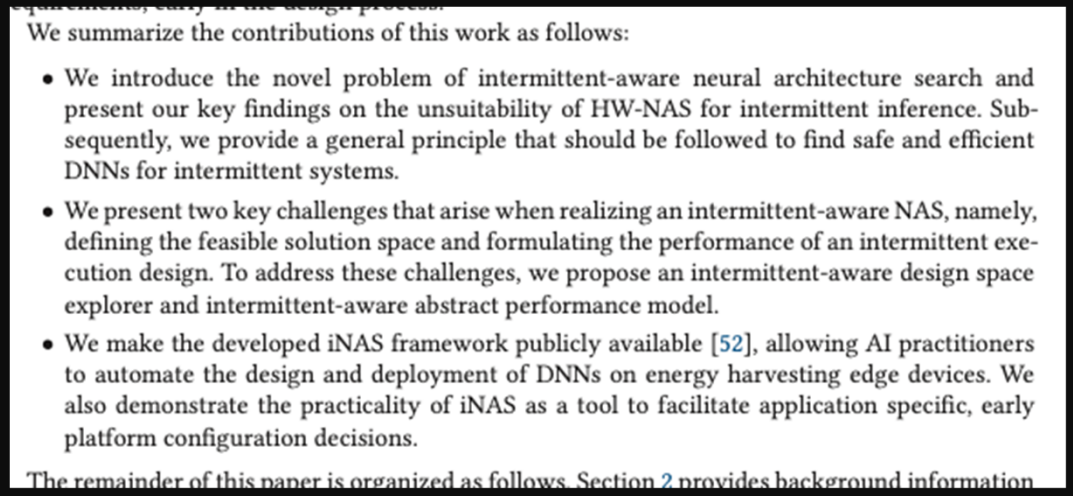
(i.e., the thesis is needed only after oral defense)

- List the paper structure with the following sections and itemize what your want to provide in this section and/or subsection
  1. Introduction (Contribution)
  2. Background
  3. Motivation
  4. Approach (Name of Your Method)
  5. Performance Evaluation
  6. Related Work
- Important Tips: Find and refer to the most related papers, copy everything from them that you need

For NTU Students

(i.e., the thesis is needed only after oral defense)

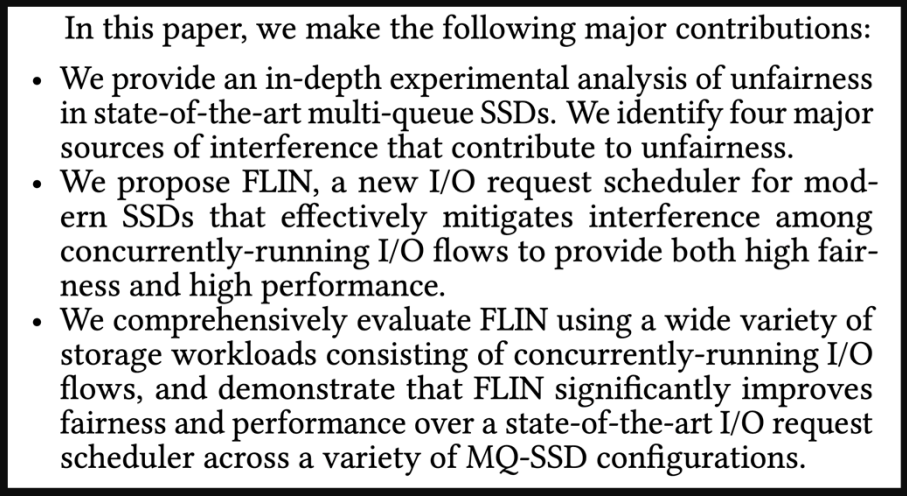
- In Introduction (Contribution) Section,
  - itemize your contributions, each with one sentence
  - to provide a high-level overview for later discussion



We summarize the contributions of this work as follows:

- We introduce the novel problem of intermittent-aware neural architecture search and present our key findings on the unsuitability of HW-NAS for intermittent inference. Subsequently, we provide a general principle that should be followed to find safe and efficient DNNs for intermittent systems.
- We present two key challenges that arise when realizing an intermittent-aware NAS, namely, defining the feasible solution space and formulating the performance of an intermittent execution design. To address these challenges, we propose an intermittent-aware design space explorer and intermittent-aware abstract performance model.
- We make the developed iNAS framework publicly available [52], allowing AI practitioners to automate the design and deployment of DNNs on energy harvesting edge devices. We also demonstrate the practicality of iNAS as a tool to facilitate application specific, early platform configuration decisions.

The remainder of this paper is organized as follows. Section 2 provides background information



In this paper, we make the following major contributions:

- We provide an in-depth experimental analysis of unfairness in state-of-the-art multi-queue SSDs. We identify four major sources of interference that contribute to unfairness.
- We propose FLIN, a new I/O request scheduler for modern SSDs that effectively mitigates interference among concurrently-running I/O flows to provide both high fairness and high performance.
- We comprehensively evaluate FLIN using a wide variety of storage workloads consisting of concurrently-running I/O flows, and demonstrate that FLIN significantly improves fairness and performance over a state-of-the-art I/O request scheduler across a variety of MQ-SSD configurations.

P.S. abstract and introduction is the last part of your paper you should write (so list out the contributions is enough in this stage)

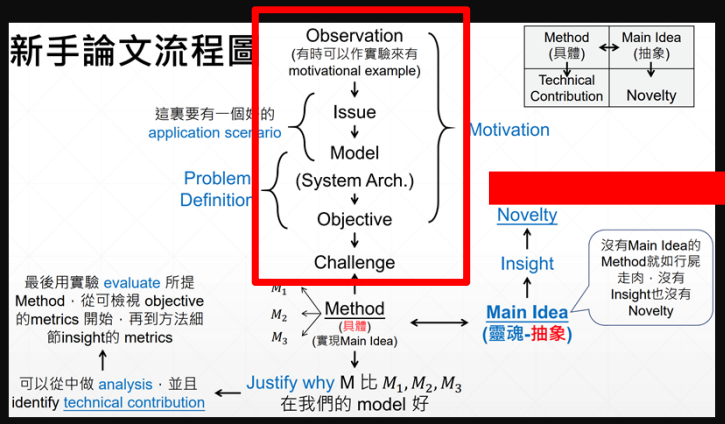
For NTU Students

(i.e., the thesis is needed only after oral defense)

- In Background Section,
  - **Purpose 1:** Tell readers the necessary background knowledges of your motivation and approach
  - **Purpose 2:** Guide the mind of readers to our battlefield (which is benefits to your motivation and approach)
  - Classify background with subsections (if more than one)
  - In each subsection, itemize all the necessary background knowledges

For NTU Students
(i.e., the thesis is needed only after oral defense)

- In Motivation Section,
  - **Purpose:** Tell how your research is strongly motivated (basically same as in your presentation slides)
  - Use subsections if needed (i.e., your work is motivated by several points)
  - Itemize your observations, research issues from the observations, challenge of this research issues, etc.
  - Insert figures if motivational example or motivational experiments are needed



This is all you need in your motivation, make sure you write all of them down

For NTU Students

(i.e., the thesis is needed only after oral defense)

- In Approach Section,
  - **Purpose:** Tell how the research issue is smartly fixed
  - A system architecture figure to show an overview of your approach is a must! Itemize the main idea of your approach
  - Use subsections to show different parts of your approach
  - Itemize (with figures, equation, and algorithm) for each subsection to tell how this part is working

For NTU Students

(i.e., the thesis is needed only after oral defense)

- In Performance Evaluation Section,
  - **Purpose:** Verify how the research issue is completedly fixed
  - ~~Two subsections: Experimental Setup and Experimental Result~~
  - Just itemize all the experiments you want to provide (insert figure if it is ready, each with one sentence)

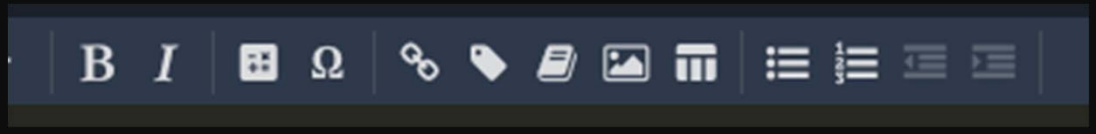
For NTU Students

(i.e., the thesis is needed only after oral defense)

- In Related Work Section,
  - **Purpose**: N/A (show your paper is well-researched, completed and ready to be published)
  - itemize the categories of related works
  - The difference between related works and background is that the former must not show any affects to your paper structure (story telling); otherwise, it should be placed in background
  - Sometime related work is important if you compare everything performance to them (and this section should be considered placed in fronter)

Tips and Reference

- All figures should be converted to bitmap and vector graphics (e.g., pdf)
- Please refer to 原豪的隨手雜記
  - 新手論文寫作重點 (Rookie's Guidance)
  - 寫一篇論文最重要的精神及論述方法
- Here is my template with ACM conference (You are suggested to refer this template for your paper writing)
- Use the tool provided by overleaf

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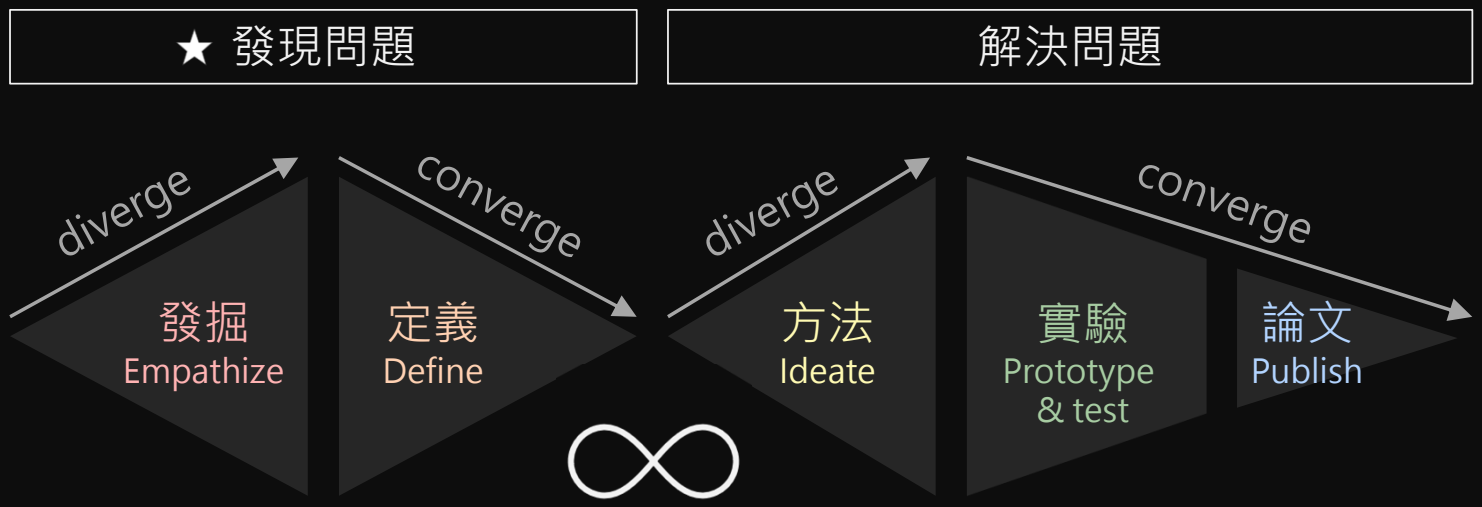
業界研究
理論
效能
理論系統
系統研究
實務系統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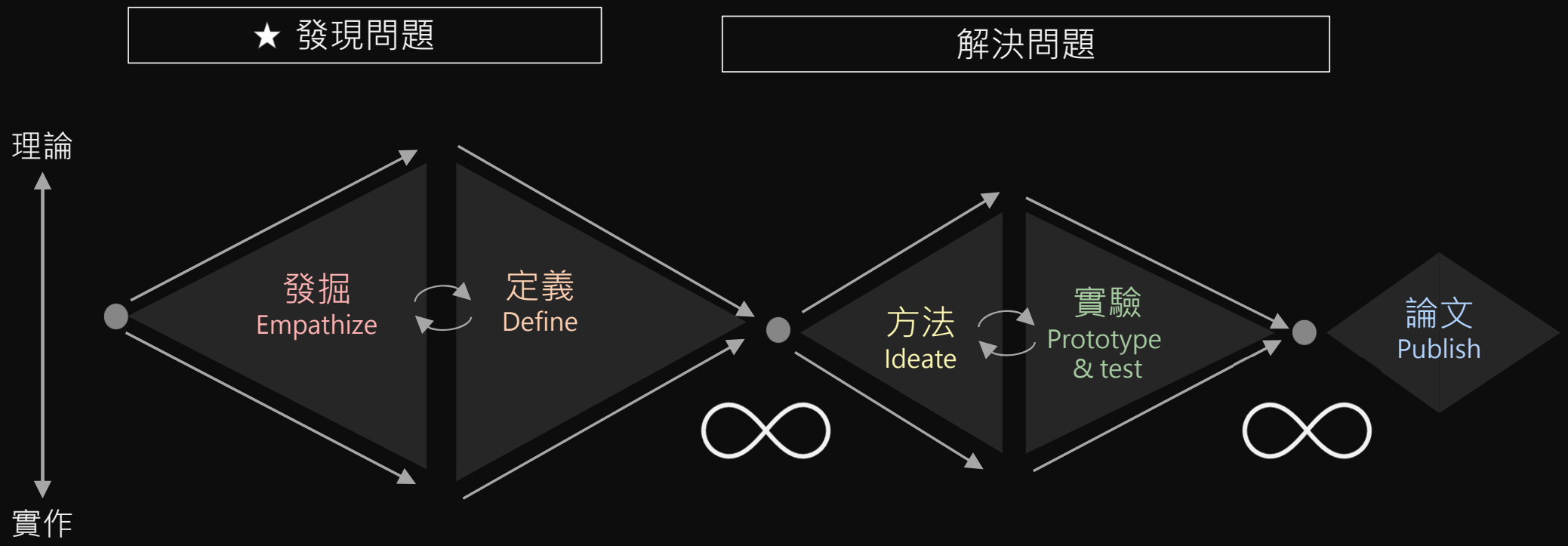
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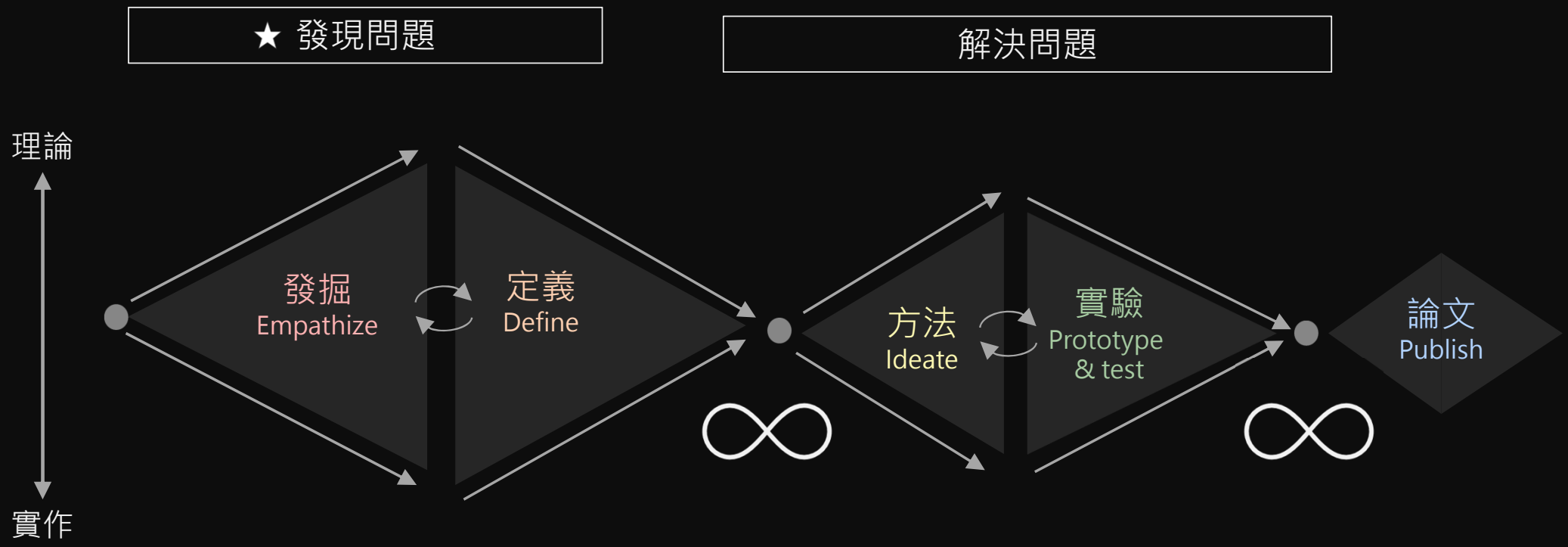
About Paper

- **How to find paper?**
  - Google Scholar with keywords
  - References of paper
  - Search with conference/journal/transaction (official website or dblp)
- **How to download paper?**
  - ACM and IEEE in NTU domain; IEEE in Academia Sinica; USENIX is free
  - Sci-Hub for all
- **How to determine conference quality?**
  - CSRankings (top tier conferences): https://csrankings.org/#/index?all&us
  - Conference Ranks: http://www.conferenceranks.com/
  - Systems Conferences by deadline (by Dan Tsafrir): http://www.cs.technion.ac.il/~dan/index_sysvenues_deadline.html
- **Others**
  - **Journal and Transaction:** TC, TCAD, TETC, TECS, TOS, JSA, etc. (a small tips: 字越少越好)
  - ArXiv (an open-access platform).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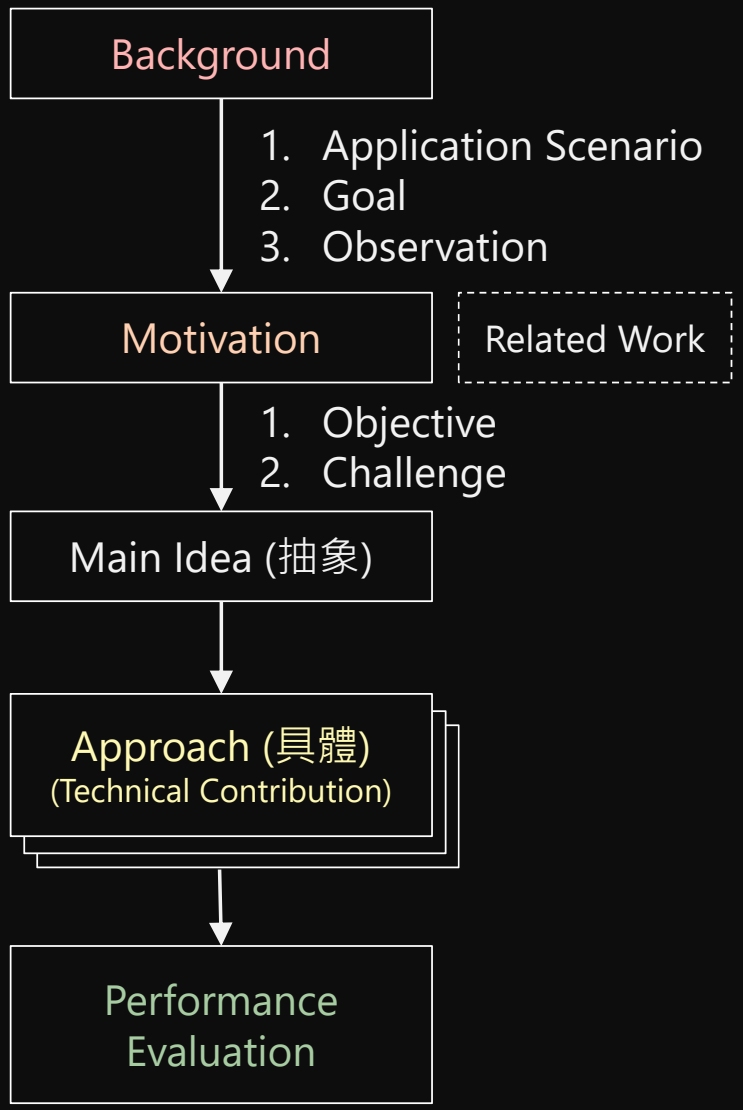
Background
1. Application Scenario
2. Goal
3. Observation
Motivation
Related Work
1. Objective
2. Challenge
Main Idea (抽象)
Approach (具體)
(Technical Contribution)
Performance
Evaluation