

Seminar course

Modern Data Center Systems

(aka “sys-seminar”)

Preliminary meeting

<https://dse.in.tum.de/>

Dr. Atsushi Koshiba
Harshavardhan Unnibhavi
Prof. Pramod Bhatotia



Course instructors



Chair of Decentralized Systems Engineering

<https://dse.in.tum.de/team/>



Dr. Atsushi Koshiba

Postdoc




Harshavardhan Unnibhavi

PhD student



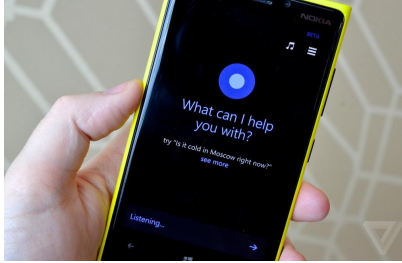
Prof. Pramod Bhatotia

Professor

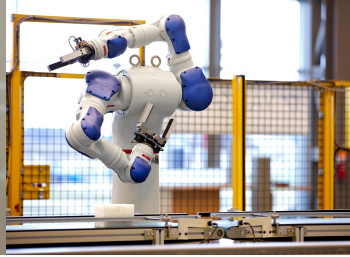


Data-driven intelligent applications

Intelligent applications



Consumer devices



Manufacturing



Healthcare



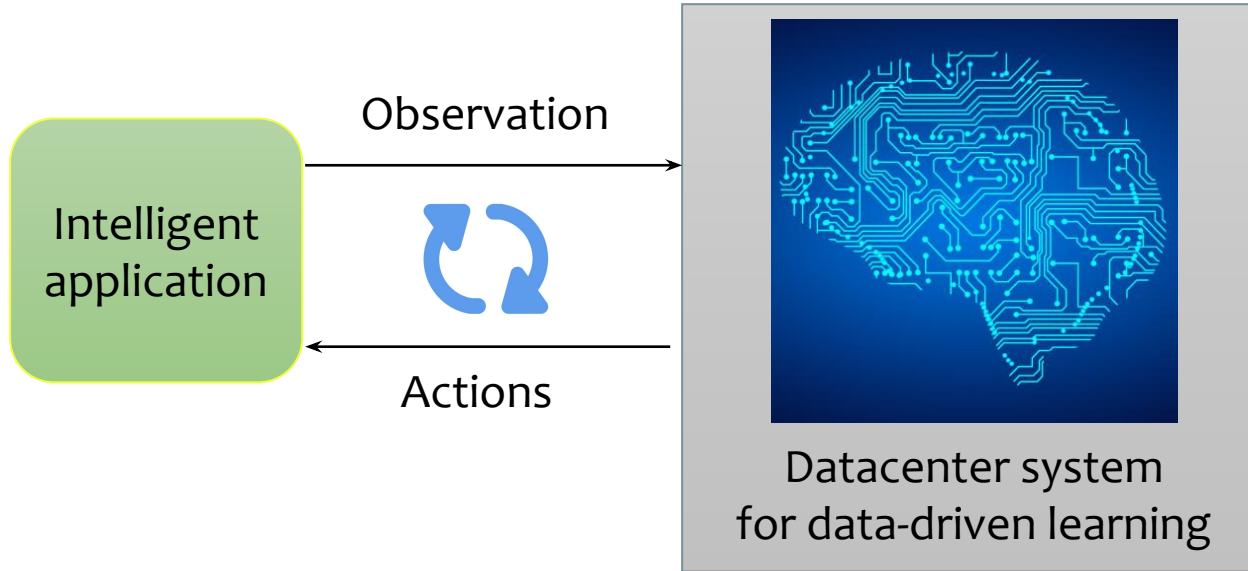
Logistics



Transportation

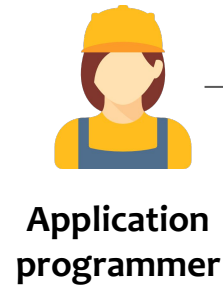


Defense



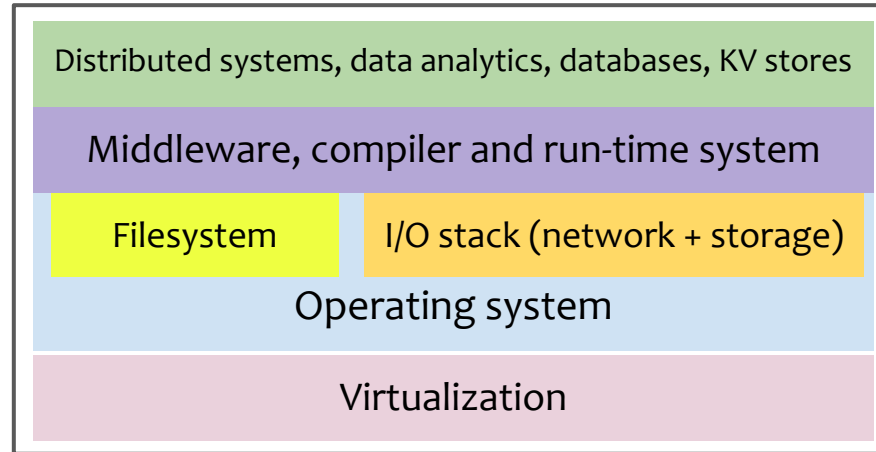
Need high-performance computing infrastructure

System stack

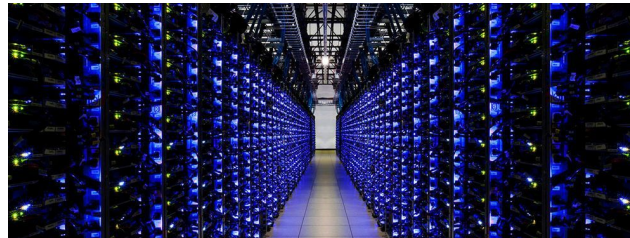


Design, build & deploy

Applications

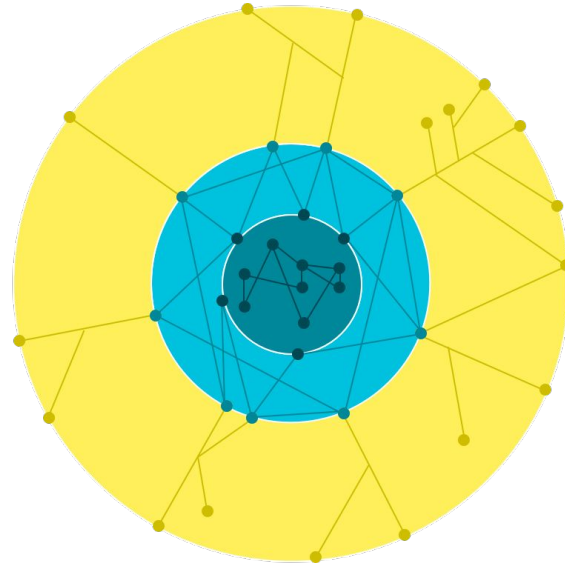


**Data center
systems**



100s-1000s of machines

The computing landscape



- Core data centers
- Edge Points of Presence (PoPs)
- Edge caching and services nodes (Google Global Cache, or GGC)



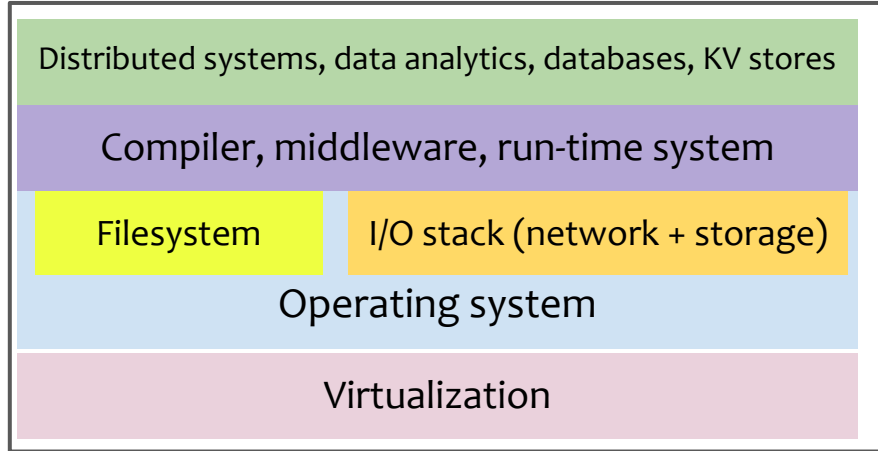
Google Cloud Platform



Source: <https://peering.google.com/#/>

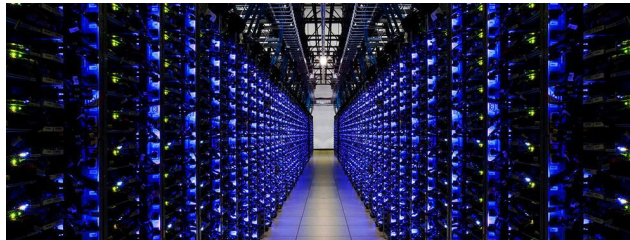
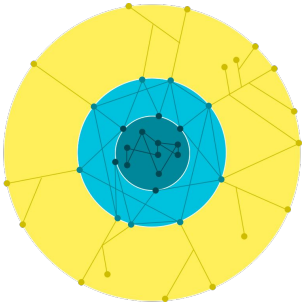
System stack

Applications



Data center systems

Scalability
Performance
Reliability
Security



Tentative topics

Papers from top systems conferences: ASPLOS, NSDI, OSDI, USENIX ATC/FAST, EuroSys, and SOSP

Tentative topics
Distributed systems
Data analytics/ML systems
Operating systems and virtualization
Storage systems
Networked systems
Systems security
Multicores/accelerators, parallelism, and synchronization
Systems reliability
...

Bird's eyes view



Team
(2 students per team)



Research papers
(Top systems conferences)



Understand



**Research
ideas**



1 presentation



1 short report



Peer-reviewing

Overview

Phase I

Kick-off



Phase II: Understand & explore

Understand



Presentation

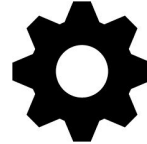


Phase III: Research

Design



Implement
(Bonus)

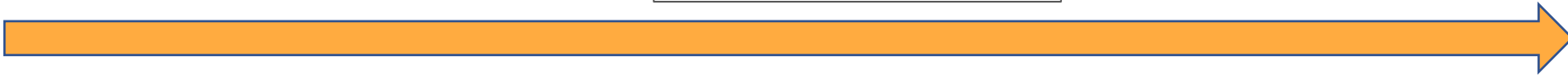


Phase IV: Report & review

Report



Peer-review



Phase I: Kick-off meeting



Format and motivation
(all participants meeting)



Team formation
(2 students per team)



Paper selection
(Top systems conferences)



The first week

NOTE

1. A list of papers will be provided for FCFS bidding
2. Paper presentation guidelines will be provided for the next phase

Phase II: Understand & explore



Understand the paper(s)

Focus

1. **Understand** the paper and related work
2. Also **explore** a “laundry list” of research ideas/directions



Paper presentation

Focus

1. Explain the work/related work (“**why?**” and “**how?**”)
2. Explain and discuss all possible research directions
3. Pick a research direction



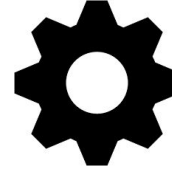
Phase III: Research



Research work

Focus:

Indepth research work to nail-down the problem and detailed approach to solve it!



Research prototype

Bonus: (Optional)

“Build the system to solve it!” and show us the working idea and associated results



Phase IV: Report & review



Report

Focus

Prepare a single “short & sweet” report summarizing

- (a) Paper
- (b) Research work



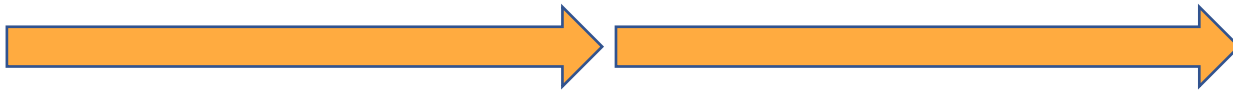
Peer-review

Focus

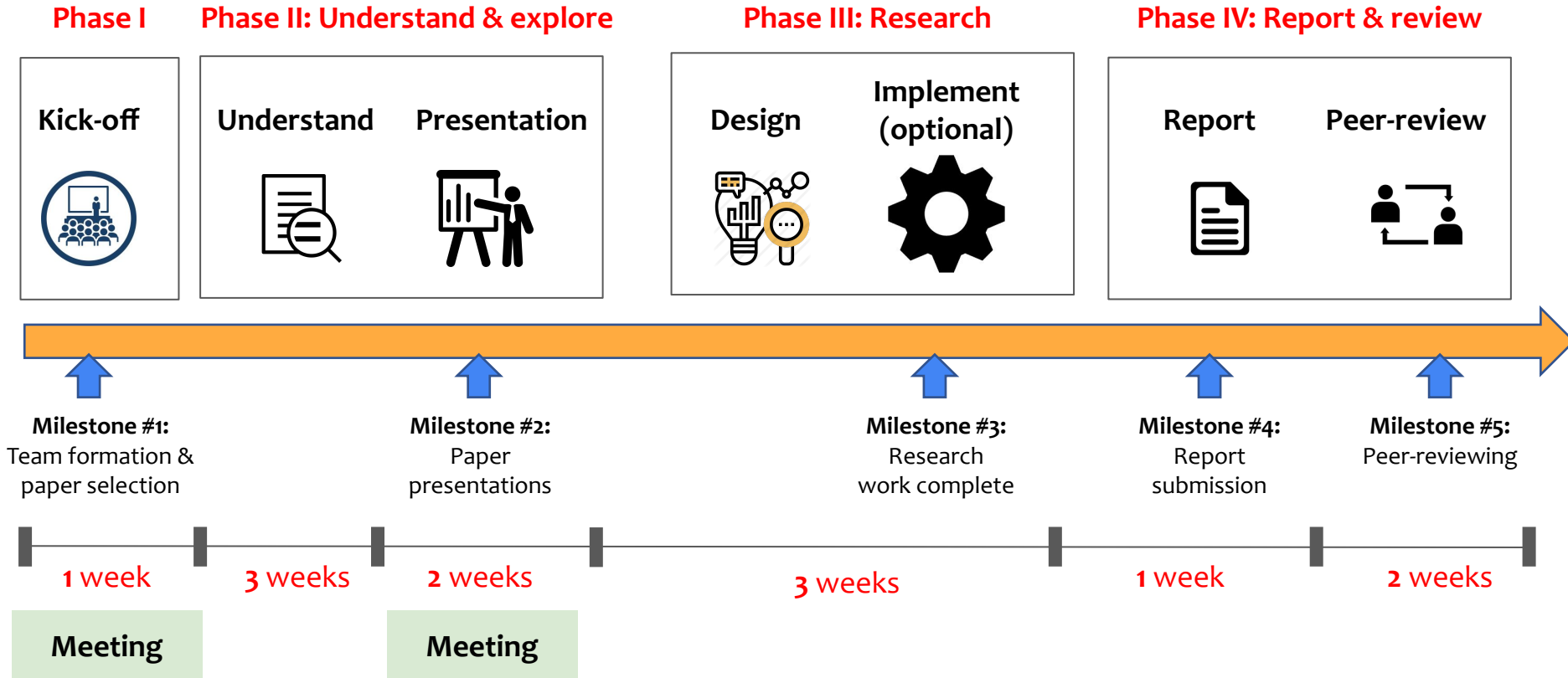
Give constructive (positive and critical) feedback for

- (a) Paper summary
- (b) Research work

END.



Overall timeline



Organization



- Format
 - Team-based seminar course (2 students per team)
- Communication
 - Slack for announcements and information sharing
 - Hotcrp for report submission and peer-reviewing
- Meetings
 - **Meeting #1:** Kick-off
 - **Meeting #2:** Paper presentation

Learning goals

- Learn about the cutting-edge research in computer systems
- Promote critical thinking
- Cultivate an environment for innovation
 - To push the boundaries by advancing the state-of-the-art
- Improve scientific skills
 - Presentation
 - Writing
 - Communication: discussion and arguing
 - Mentorship: giving feedback and moderating discussion
- Encourage system building and evaluation
 - Learn by building, breaking, and benchmarking systems
- Importantly, to have fun!

Interested?



Matching platform

Welcome to the Matching platform matching.in.tum.de/!

Dear students,

we changed the name of the course "Seminar: Recent advances in Computer Systems", for consistency reasons. The new name are "Seminar: Hot Topics in Computer Systems", now.

Login with your TUM identifier.

 TUM login

Login for exchange students
(without TUM identifier)

 Exchange student login

Any questions? Visit the FAQs!

 FAQs

Sign up on the TUM matching platform

Contacts

- Dr. Atsushi Koshiba
 - atsushi.koshiba@tum.de
- **All seminar-related info:** <https://github.com/TUM-DSE/seminars>



Workspace: <http://ls1-courses-tum.slack.com/>

Channel: #ss-23-sys-seminar

Join us with TUM email address (@tum.de)

Notes

(Please go over them for details!)

NOTE

Grading

Category	Details	Points
Research ideas	Novelty of research ideas and approach	30%
Presentation	1 Presentation	30%
Report	1 report (summarizing paper and research)	20%
Peer-reviewing	Peer-reviewing of the reports and participation in the seminar	20%

NOTE

Paper selection and reading

Note: Paper selection

- Reading list:
 - A list of papers will be provided from the top conferences in this area
 - Students can also nominate their papers (with due permission from the instructor)
- Paper assignment:
 - FCFS bidding process
 - Two students per paper/topic (*see the list*)
 - Please indicate your preference by semester's **1st week**

Guidelines for paper reading



- Follow Keshav's three-pass approach (see references)
 - First pass: Get the general idea (5-10 minutes)
 - Read the abstract, introduction, conclusions
 - Check section headings, and references
 - Second pass: Grasp the paper's content (1 hour)
 - Read the full paper, ignore proofs/details
 - Carefully read the figures, identify key points
 - Mark important references
 - Third pass: Understand the paper in depth (4-5 hours)
 - Try to understand everything and reconstruct the approach
 - Be critical, challenge assumptions, validate the state-of-the-art
 - Possible generate your own ideas

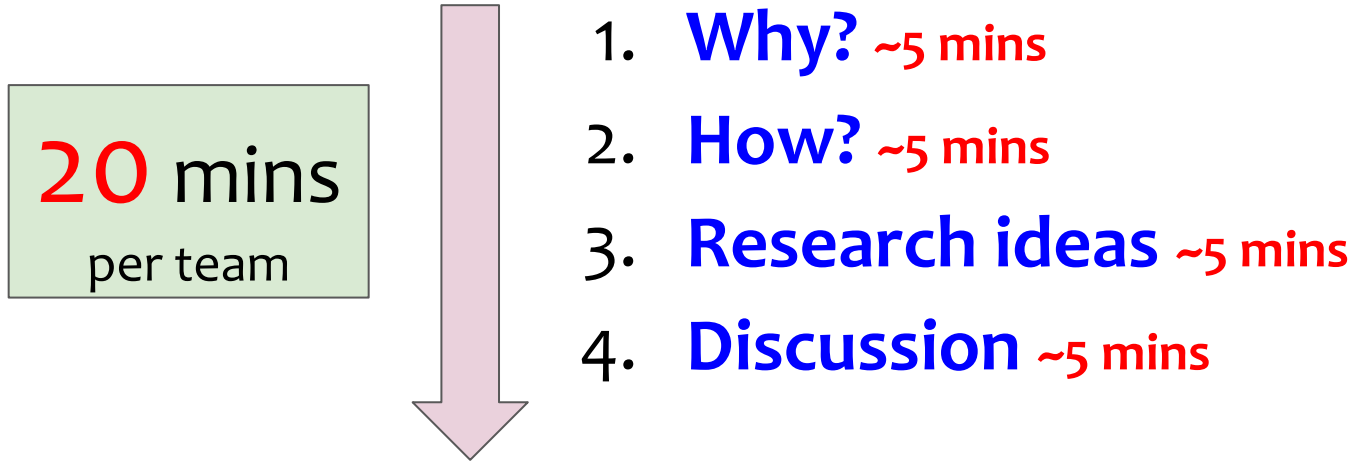
References

- How to read a paper
 - S. Keshav: How to Read a Paper
 - <http://ccr.sigcomm.org/online/files/p83-keshavA.pdf>
 - Philip Fong: How to Read a CS Research Paper
 - <http://www2.cs.uregina.ca/~pwlifong/CS499/reading-paper.pdf>

NOTE

Presentation

- Structure your presentation across four dimensions



Presentation guidelines

1. Context of the work (“Why”?)
 - a. What is the problem?
 - b. Why is it important or interesting?
 - c. What is the state-of-the-art? What is the “research gap”?
 - d. Why is it difficult? Or what are the challenges?
2. Contributions of the work (“How”?)
 - a. What is the proposed solution?
 - b. What are the key insights?
 - c. Or what are the novel aspects?
3. Potential of future work (“Research ideas”)
 - a. How can you improve the solution or evaluation?
 - b. Are there any other interesting problems or alternative approaches?
 - c. Can the proposed techniques or solutions be applicable for different problems/context?

At this stage: It's OK to have a laundry list of potential ideas!

We will jointly brainstorm and pick one idea for the research exploration phase

Presentation template



- Please prepare your presentation using the following template:

<https://docs.google.com/presentation/d/1iuR1TtARibgV4iEaoorx7tP5leyjZISkwdpIPyn6cso/edit?usp=sharing>

- If you hesitate to use Google docs for personal/data protection issues, please feel free to use a different software.

- How to give presentation
 - Markus Puschel: How to give good technical presentations
 - <https://people.inf.ethz.ch/markusp/teaching/guides/guide-presentations-new.pdf>
 - Simon Peyton Jones: How to give a great research talk
 - <https://www.microsoft.com/en-us/research/academic-program/give-great-research-talk/>

NOTE

Report

preparation and submission

- We require a report covering two parts:
 - Part A: Paper summary
 - Part B: Research proposal
- Report format
 - Short and sweet
 - At most 4 pages (2 pages for each part), excluding references
 - USENIX format:
<https://www.usenix.org/conferences/author-resources/paper-templates>

Part A: Paper summary (2 pages)

1. Context of the work (“Why”?)
 - a. What is the problem?
 - b. Why is it important or interesting?
 - c. What is the state-of-the-art? What is the “research gap”?
 - d. Why is it difficult? Or what are the challenges?
2. Contributions of the work (“How”?)
 - a. What is the proposed solution?
 - b. How it works at a high-level?
 - c. What are the key insights?
 - d. Or what are the novel aspects?

Part B: Research proposal (2 pages)

1. Context of your research (“Why”?)
 - a. What is the problem?
 - b. Why is it important or interesting?
 - c. Why is it difficult? Or what are the challenges?
2. Approach of your research work (“How”?)
 - a. What is the proposed solution? How does it work?
 - b. What are the key insights?
 - c. Or what are the novel aspects?
3. “Bonus”!
 - a. Did you implement the solution?
 - b. Show us the demo/results!!

Report submission



- HotCRP portal
 - Standard portal used in conferences for submission and reviewing
 - HotCRP portal link will be shared on Slack
 - Create an account in HotCRP (*same account is valid for submission and reviewing*)
- Submission fields in HotCRP
 - Single PDF for the report
 - Specify conflicts (*your team members*)
 - GitHub link for the system code (*optional*)

- How to write report
 - Simon Peyton Jones: *How to write a great research paper*
 - <https://www.microsoft.com/en-us/research/academic-program/write-great-research-paper/>
 - *How to write a great research proposal*
 - <https://www.microsoft.com/en-us/research/academic-program/how-to-write-a-great-research-proposal/>

NOTE

Peer-reviewing

Note: Peer-reviewing

- Reviewing reports (*comment on paper summary and research proposal*)
 - Positive aspects (3-4 points)
 - Critical aspects (3-4 points)
 - Grade recommendation
- HotCRP portal
 - Standard reviewing portal used in conferences
 - “Single-blind” reviewing: Reviewers are anonymous

References

- How to write reviews
 - Timothy Roscoe: *Writing reviews for systems conferences*
 - <https://people.inf.ethz.ch/troscoe/pubs/review-writing.pdf>
 - Shriram Krishnamurthi: *How to Write Technical Paper Reviews*
 - <https://cs.brown.edu/~sk/Memos/Paper-Reviews/>

NOTE

Class participation

- Participants
 - Active participation: Read, discuss, and analyze papers
 - Jointly brainstorm: Limitations, possible extensions, or alternative approaches
 - Provide constructive feedback to the presenters
- Moderator (*Optional*)
 - You can volunteer to be a moderator
 - Shepherd and manage the session
 - Encourage active participation
 - Summarize the discussion

- University plagiarism policy
 - <https://www.in.tum.de/en/current-students/administrative-matters/student-code-of-conduct/>
- Decorum
 - Promote freedom of thoughts and open exchange of ideas
 - Cultivate dignity, understanding and mutual respect, and embrace diversity
 - Racism and bullying will not be tolerated

NOTE

System building/evaluation

Optional BONUS component!

- Goal: To learn by building and breaking stuff!
- Possible options:
 - Implement paper's key ideas from scratch (or using open-source software)
 - Extend/modify the system to support new features
 - Validate and compare w/ alternative approaches
 - Benchmark the system
 - Evaluate system under different assumptions or workloads

- Systems research:
 - Peter Druschel: How to do systems research
 - <http://conferences.inf.ed.ac.uk/EuroDW2018/keynotes/Peter-Druschel-Keynote.pdf>
 - Steve Hand: Doing a Systems PhD
 - <http://homepage.tudelft.nl/8e79t/files/StevenHand.pdf>
 - James Mickens: The Night Watch
 - https://www.usenix.org/system/files/1311_05-08_mickens.pdf

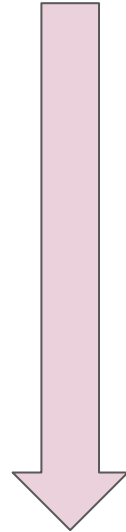
NOTE

Research presentation

Format: Presentation #2

- Structure your “research” presentation across four dimensions

15 mins
per team



1. **A quick recap!** ~2 mins
2. **Why?** ~5 mins
3. **How?** ~5 mins
4. **Let's discuss!** ~3 mins
5. **BONUS!** (optional)

Research presentation guideline

1. **“A quick recap”**
 - a. Briefly remind your paper
2. Context of your research (**“Why”?**)
 - a. What is the problem?
 - b. Why is it important or interesting?
 - c. Why is it difficult? Or what are the challenges?
3. Approach of your research work (**“How”?**)
 - a. What is the proposed solution? How does it work?
 - b. What are the key insights?
 - c. Or what are the novel aspects?
4. **“Bonus”!**
 - a. Did you implement the solution?
 - b. Show us the demo/results!!

Important dates

Meetings	Date (Thu at 13:00h)
Kick-off	28th April 2022
Presentation	26th May and 2nd June, 2022

Submission dues	Date
Report	7th July 2022
Peer-reviews	21st July 2022