

Seminar course

# Modern Data Center Systems

(aka “sys-seminar”)

Preliminary meeting

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

Prof. Pramod Bhatotia



# About me

- Professor at TUM (Sept 2020 - present)
  - Chair of Decentralized Systems Engineering
  - **Interests:** distributed systems, operating systems, security and reliability
- Faculty at UoE
  - Professor (Jan 2021 - present)
  - Associate Professor (Oct 2016 - Dec 2020)
- Industry experience
  - Technical Director at Huawei Research Germany (Jan 2019-Aug 2020)
  - Past affiliations: IBM Research, Bell Labs, Microsoft Research, Yahoo! Labs
- PhD at Max Planck Institute for Software Systems (MPI-SWS)



# Three important trends

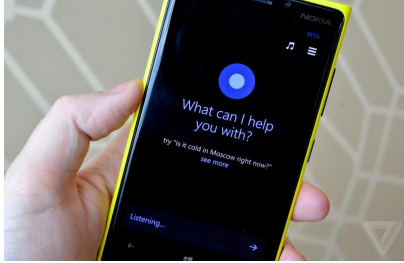


Computing

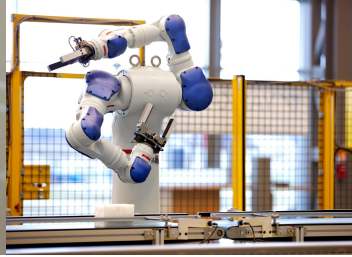


Data-driven intelligent applications

# Intelligent applications



Consumer devices



Manufacturing



Healthcare



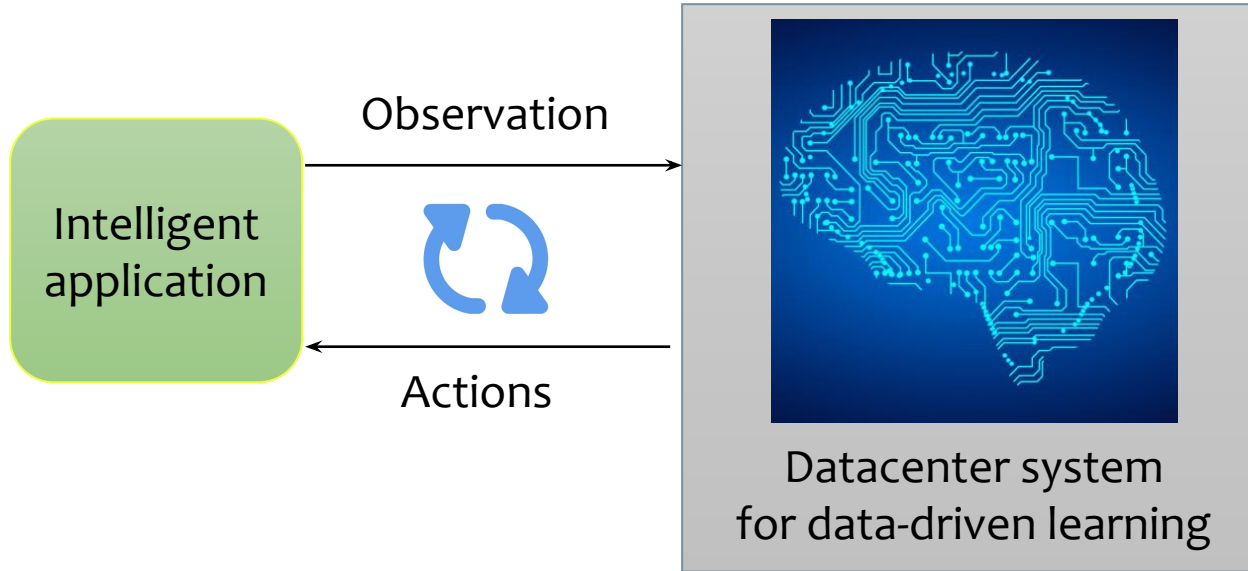
Logistics



Transportation



Defense



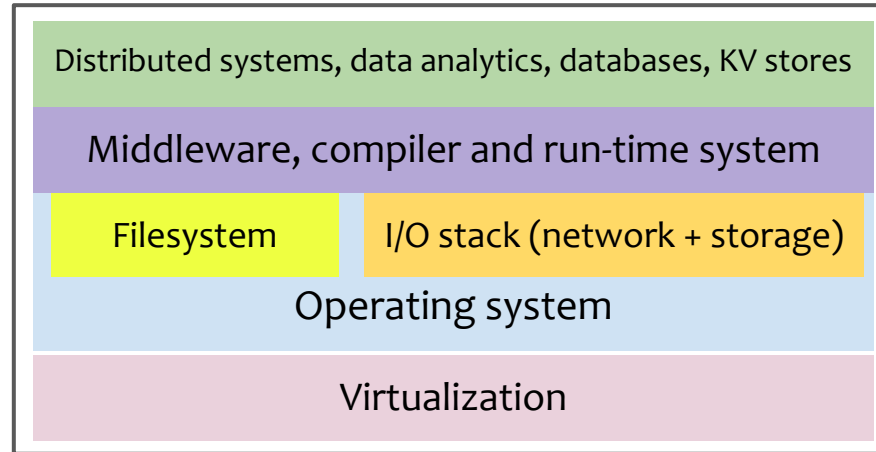
Need high-performance computing infrastructure

# System stack

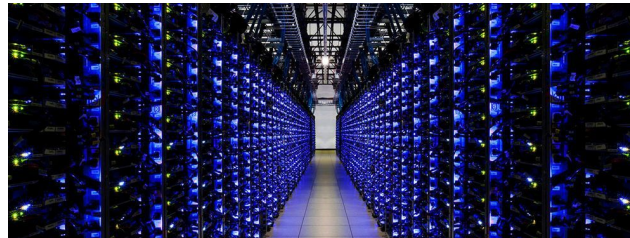


Design, build & deploy

Applications

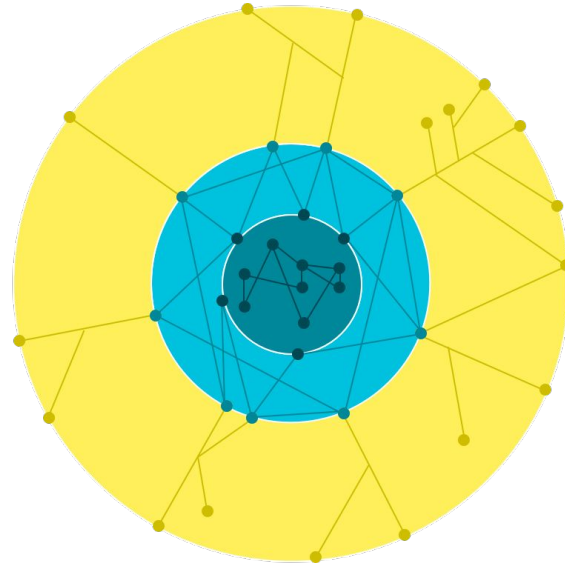


**Data center  
systems**



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)



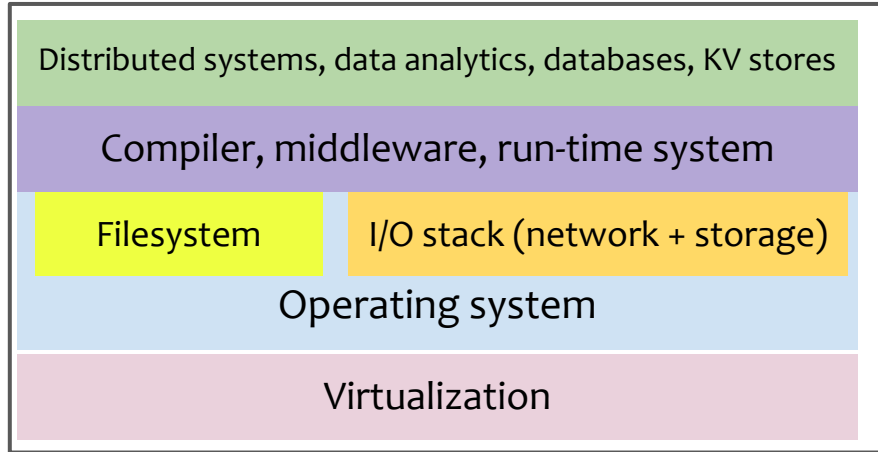
Google Cloud Platform



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

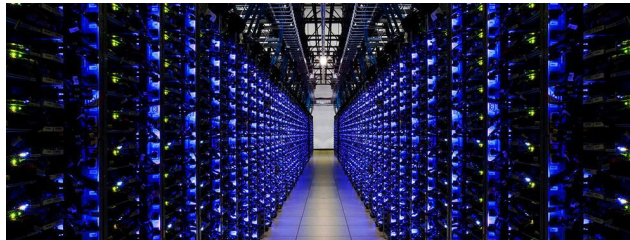
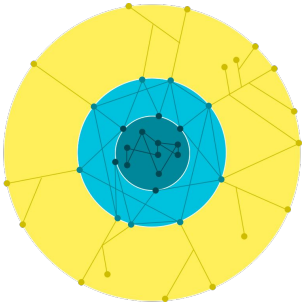
# System stack

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

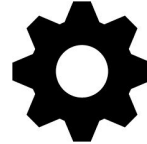


## Phase III: Research

Design



Implement  
( Bonus)

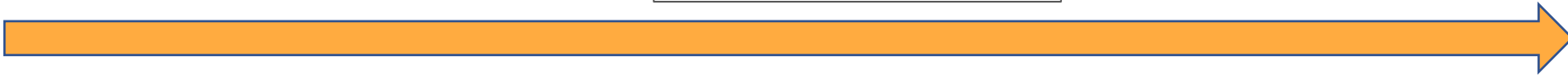


## Phase IV: Report & review

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



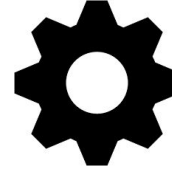
# Phase III: Research



## 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



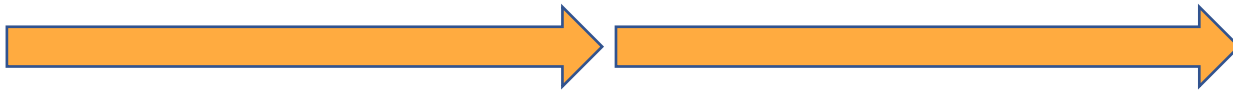
## Peer-review

### Focus

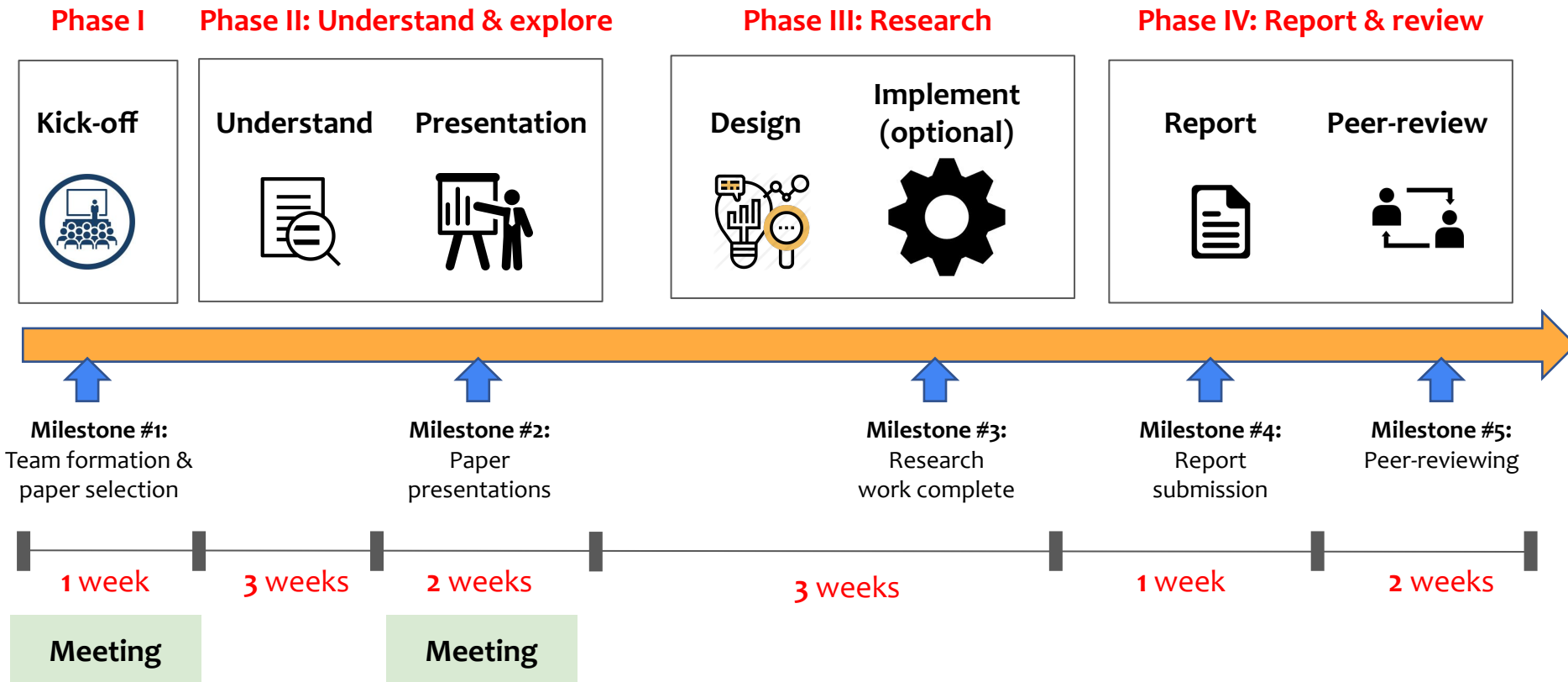
Give constructive (positive and critical) feedback for

- (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/](https://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

# Contact



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  - [pramod.bhatotia@in.tum.de](mailto:pramod.bhatotia@in.tum.de)



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

**Channel:** # will be announced separately

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

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