Seminar course

Modern Data Center Systems

(aka “sys-seminar”)

Preliminary meeting

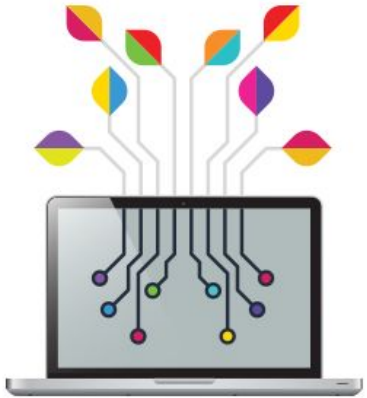
https://dse.in.tum.de/

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)

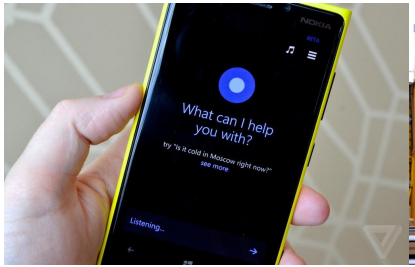
Three important trends



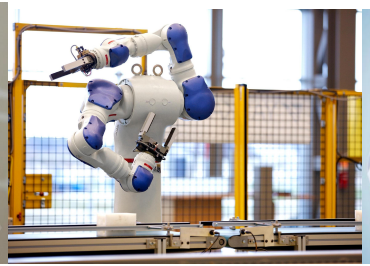
Computing

Data-driven intelligent applications

Intelligent applications



Consumer devices



Manufacturing

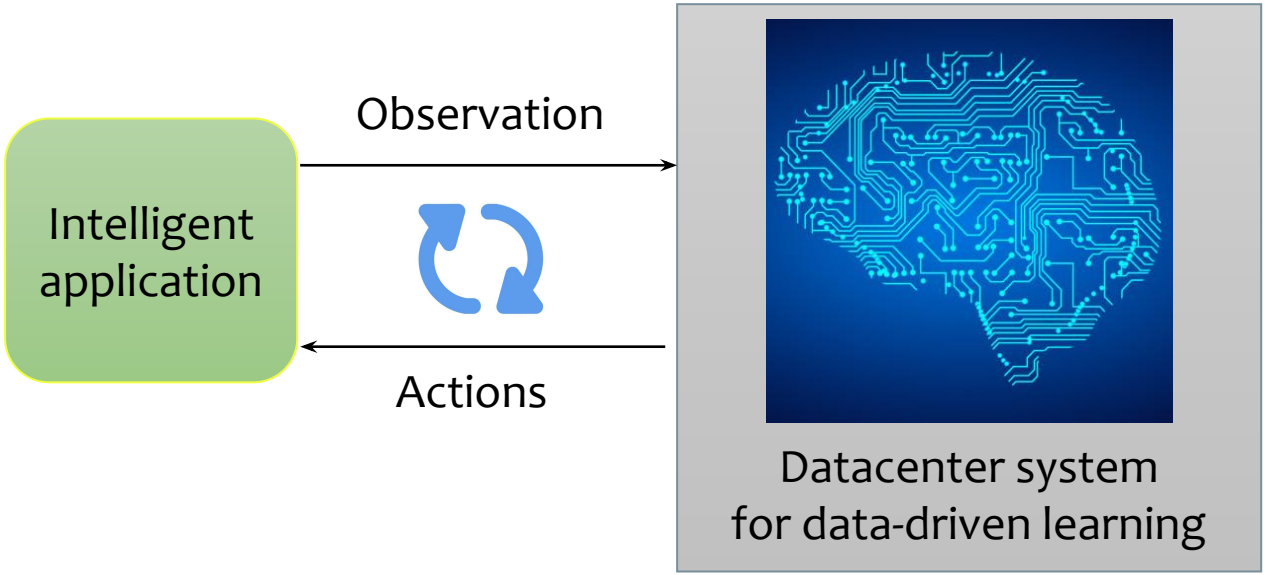
Healthcare

Logistics

Transportation

Defense

System design



Need high-performance computing infrastructure

System stack

Application programmer

Design, build & deploy

Applications

Distributed systems, data analytics, databases, KV stores

Middleware, compiler and run-time system

Filesystem

I/O stack (network + storage)

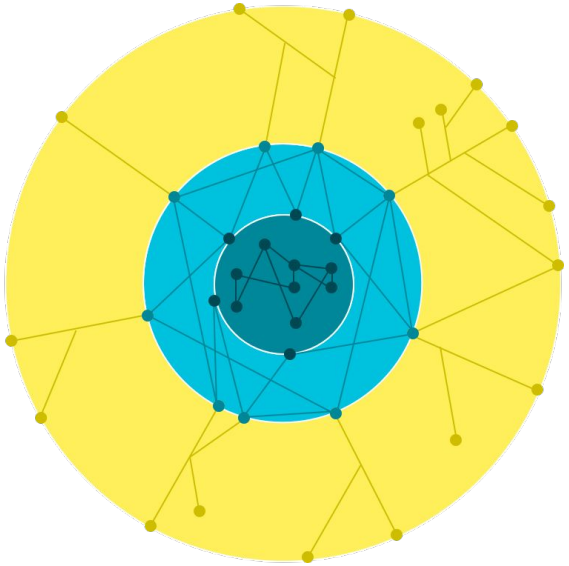
Operating system

Virtualization

100s-1000s of machines

Data center systems

The computing landscape



Google Cloud Platform

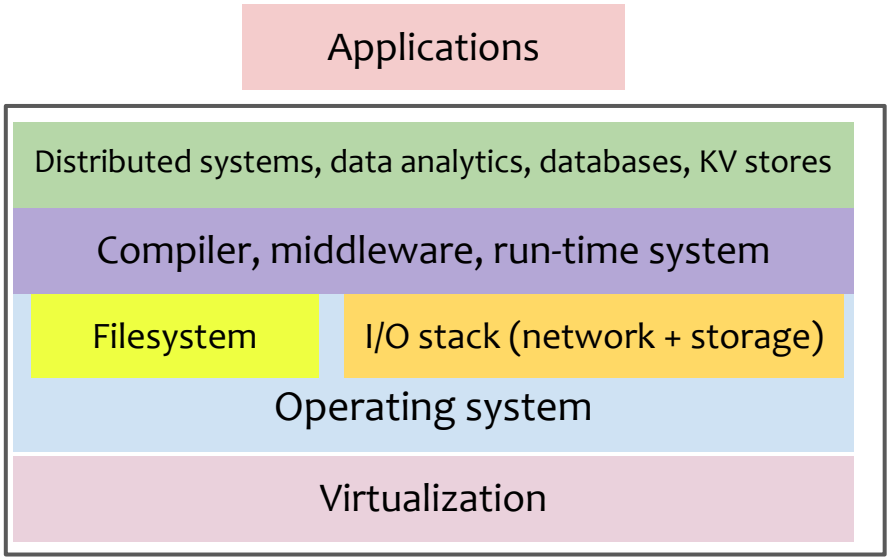
amazon web services

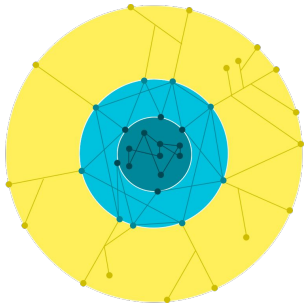
Microsoft Azure

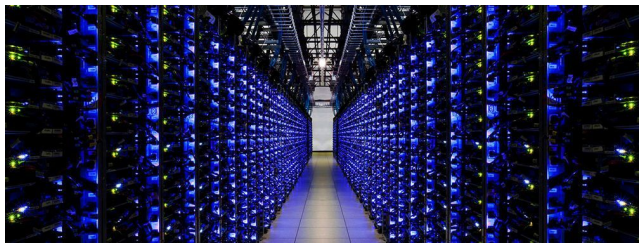
- Core data centers
- Edge Points of Presence (PoPs)
- Edge caching and services nodes (Google Global Cache, or GGC)

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

System stack







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)

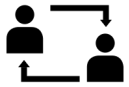
Research papers
(Top systems conferences)

Understand

Research ideas

1 presentation

1 short report



Peer-reviewing

Overview

Phase I

Kick-off

Phase II: Understand & explore

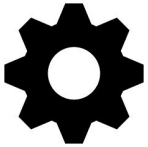
Understand

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

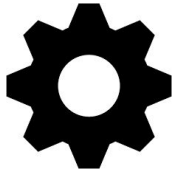
Focus

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

Phase I

Kick-off

Phase II: Understand & explore

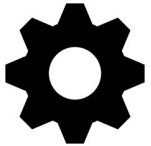
Understand

Presentation

Phase III: Research

Design

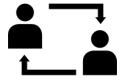
Implement (optional)



Phase IV: Report & review

Report

Peer-review



Milestone #1: Team formation & paper selection

Milestone #2: Paper presentations

Milestone #3: Research work complete

Milestone #4: Report submission

Milestone #5: Peer-reviewing

1 week

3 weeks

2 weeks

3 weeks

1 week

2 weeks

Meeting

Meeting

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

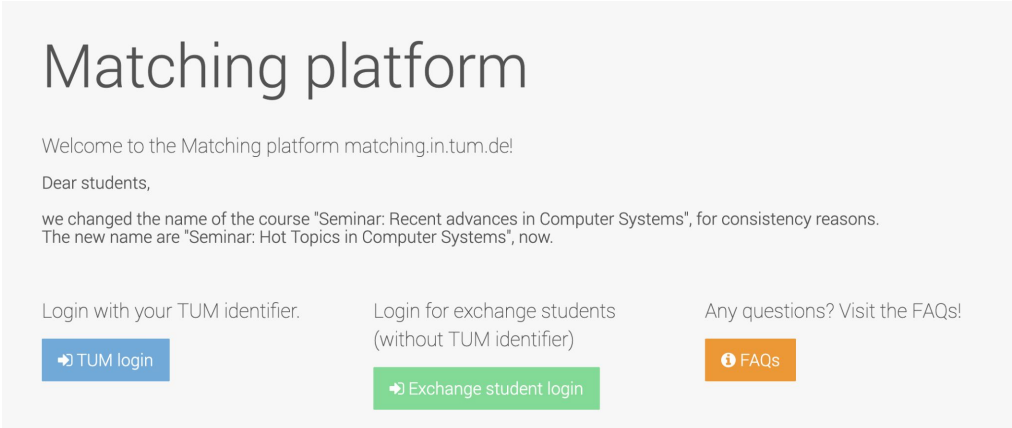
- Learn about the cutting-edge research in computer systems
- Promote critical thinking
- Cultivate an environment for innovation
  - To push the boundaries by advancing the state-of-the-art
- Improve scientific skills
  - Presentation
  - Writing
  - Communication: discussion and arguing
  - Mentorship: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

Code of conduct

- 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

Interested?



Sign up on the TUM matching platform

Contact

- Prof. Pramod Bhatotia
  - 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/