



CS 537

Advanced Topics in Internet of Things
Lecture 1 – Introduction
(Course Organization)

Klara Nahrstedt
Fall 2021

Overview

- Course information
 - Personnel,
 - Policy,
 - Schedule,
 - Grading,
 - Projects Discussion

Instructor Introduction

■ Klara Nahrstedt

- PhD 1995 from Department of Computer and Information Science, University of Pennsylvania
- Research:
 - **Networking** (routing, QoS management, pricing),
 - **Multi-modal Distributed systems** (overlay multicast, peer-to-peer systems, service composition, resource management),
 - **Mobile computing** – smart phones protocols – P2P, video streaming over mobile phones, group management, ...
 - **Operating systems** (soft-real-time scheduling, caching),
 - **Multimedia applications** (multi-view 3D tele-immersive systems, multi-camera systems, collaborative environments, mobile multimedia, P2P IPTV, multi-view 360 Video Streaming)
 - **Multimedia and critical infrastructure security** (watermarking, real-time security)
 - **Cloud computing/Edge Computing**
 - **Internet of Things**

Course Logistics

■ *Office Assistant:*

- Candice Steidinger (steidin2@illinois.edu)
- If you need to meet with me outside of office hours, please ask Candice for an appointment. She has access to my calendar and will help you very fast.

■ *Teaching Assistant: Ayush Sarkar*

- Any questions you have, please, email
 - Instructor klara@illinois.edu with subject line “CS537 or
 - Teaching assistant ayushs2@illinois.edu

■ *Class Time:* Tuesday and Thursday 2:00-3:30pm

■ *Class Place:* virtual zoom

■ *Zoom link is available on compass2g*

Course Logistics

■ *Instructor Office Hours:*

- **Tuesday and Thursday 4:00pm - 5:00pm CST**
- **Use the same zoom link as for the class**
- Phone: 217-244-6624

■ *Class Website – Reading List on the website and compass2g*

■ *Discussion, Announcements, and Postings:*

- *Compass2g app*
- *Campuswire app*

■ *Grading Center: <https://compass2g.illinois.edu>*

Required Readings for CS 537

- Papers in Reading List (posted on class website)
 - <https://courses.grainger.illinois.edu/cs537/fa2021>
- Lectures and Discussion in class
 - Papers in class plus optional papers

Other Readings for CS 537

■ ***IoT Books and Papers***

- *“Internet of Things and Big Data Analytics”, Edited by P. Raj et al, CRC Press, 2020*
- *“Analytics for the Internet of Things (IoT)”, Andrew Minter, Packt Publishing, 2017*
- *.... Many conference and journal papers from ACM and IEEE professional orgs*
 - *ACM IOTDI (Internet of Things Design and Implementation)*
 - *ACM IPSN (Information Processing of Sensor Networks)*
 - *IEEE MASS (International Conference on Mobile Ad-Hoc and Smart Systems)*
 - *ACM/IEEE CPS-IOT Week),*
 - *ACM SEC (Symposium on Edge Computing)*
 - *Many conferences on cloud computing (e.g., ACM SoCC – Symposium on Cloud Computing)*

■ ***Multimedia Books and Papers***

- *Media Coding and Content Processing, Ralf Steinmetz, Klara Nahrstedt, Prentice Hall, 2002*
- *Multimedia Systems, Ralf Steinmetz, Klara Nahrstedt, Springer Verlag, 2004 (online book free)*
- *... many other conference and journal papers from ACM and IEEE professional orgs*
 - *ACM International Conference on Multimedia,*
 - *ACM MMSys (Multimedia Systems)*
 - *ACM ICMR, (International Conference on Multimedia Retrieval)*
 - *IEEE ICME (International Conference on Multimedia and Expo)*
 - *IEEE CVPR (International Conference on Computer Vision and Pattern Recognition)*
 - *IEEE ICASSP (International Conference on Acoustics, Speech, and Signal Processing)*
 - *ACM and IEEE TMM (Transactions on Multimedia)*

Course Prerequisites

- It is helpful if you have taken at least one of these classes in your undergrad studies
 - CS 425 (distributed systems undergrad) and/or
 - CS 438 (networking systems undergrad)
 - CS 437 (Internet of Things systems undergrad)
 - 400-level computer vision class

Goal of the Course

- **Expand breath of knowledge** in the area of multi-modal IoT systems through
 - Learn new Multi-Modal IoT-specific system and networking concepts
 - Learn new mathematical and design tools to model and design complex systems that run multi-modal IoT systems
- **Learn scientific tools for your MS/PhD theses**
 - Learn how to critique scientific papers (review)
 - Learn how to ask questions and prepare answers
 - (More and more conferences ask for rebuttals to reviewers' questions)
 - Learn how to prepare and present a scientific work as lecture
 - Learn how to present related work
 - Learn how to prepare project proposal
 - Learn how to prepare project presentation and final project report

Class Format

- Class will consist of partially
 - lecturing by instructor, TA, guest lecturer and
 - lecturing by students based on reading list
 - paper discussions
- Students' responsibility
 - Attend lectures
 - Read papers!!
 - Work on presentations, questions, reviews, evaluation, midterm exam, project, lectures
 - Look for new material and **post on campuswire** when you find interesting papers, tools, other material to share

Workload (1a)

Lecturing and Q&A

- Student presents **1 paper presentation** (Paper #1)
- Student presents **2nd paper** (Paper #2)
- TA will setup a sign-up sheet with papers and students can select papers for presentations

Workload (1b)

- Instructions regarding sign-up sheet and selection will be placed on campuswire.
- Paper assignment will be on a **first-come-first-serve policy**
 - Student presents the papers synchronously in zoom-class
 - Instructor evaluates the lectures, and discussions

Workload (2)

- **Paper Reviews and Evaluation of Reviews**
 - Each student selects three papers for review which are
 - different from Paper #1
 - different from Paper #2
 - different weeks (3 reviews should be from papers over 3 weeks – one paper per week to review).
 - Send your selected three papers to the TA.
 - Review information will be then posted on campuswire.
 - Reviews will be evaluated by the TA

Workload (3)

■ Take-Home Midterm Exam

- Questions will be asked from Lectured material and papers presented prior to exam
- Problems will include material covered in papers and lectures to answer the midterm questions

Workload (4)

- **Final project** will include three parts:
- 1. project proposal
- 2. project presentation in class
- 3. project paper

Lecturing

- Each student needs to present **Paper #1** and **Paper #2**
 - Each student selects choice of papers in sign-up sheet
 - Details about sign-up sheet will be posted on campuswire
 - Selection of papers will be based on **First Come First Serve**
 - Assignments will be posted on the class website in the **Reading List**
- The **sign-up sheet** will open on **September 13** and close on **September 17, 2021**

Lecture Format for Papers' Presentation

- Paper presentation should be **20 minutes maximum** to leave at least 10 minute for discussion
- You should plan 1-2 minutes per slide, so having around 15-20 slides
 - Use simple strong contrast colors
 - Do not make the slide too busy
- **Post your slides on campuswire before lecture or send it to TA/instructor**

Lecture Format (2)

- Your presentation should include
 - **Motivation of the problem** (why are we looking at this issue? What is the environment where the problem resides?)
 - **Problem Description** (What is the problem and what are the challenges of the problem?)
 - **Background** (How did other people solve this problem and why isn't this enough?)
 - **Novel approach** (solution described in the paper)
 - **Validation of approach**
 - **Conclusion with Pros and Cons of Paper**

Paper Reviews

- Each student sends list of 3 papers (different from the 2 papers to present and each review is done in different week)
 - Email to TA your three papers to be reviewed
 - Use the review format as specified in this lecture
 - Post the review on campuswire under “paper_reviews” chatroom
- Deadline for each Review is **day before the paper is presented (11:59pm)**
- TA evaluates reviews

Peer Reviews Format

- Review should include:
 - **Title, authors, venue** of the published paper
 - **Short overview of the paper** (what is the main idea of the paper) – few sentences
 - **3-5 pros items** – positive sides of the paper – why was the paper accepted
 - **3-5 cons items** – negative sides of the paper – what are still missing pieces of the work;
 - **Comments** on how would you improve the paper?
- Note: review should be ½-1 page long; write full sentences and be clear (don't just put keywords)
 - Think like a reviewer and member of a technical conference committee



Evaluation of Reviews

- Summary of the paper (concise description of the idea)
- The pros and cons items if they are valid
- Improvement suggestions to the paper
- What the reviewer has done well and what could be improved

Take-Home Midterm Exam

- Midterm exam will be (**Note change!!!**)
 - Posted on October 25 (Monday 11:59pm)
 - Due on November 1 (Monday 11:59pm)
- Use lectures, web material and papers to find answers
- Submit midterm-exam solutions in pdf format to klara@illinois.edu, subject line: “CS537 – Midterm”

Final Project (1)

- Each student must work on a **class project** in multi-modal/IoT system/network area
 - Consider continuation of your research projects if it has IoT context
 - Consider exploring new topic towards your research
 - Come and see instructor during office hours if you need suggestions for class project (or setup a meeting via Candice with the instructor)
 - **You can work alone, or in group of 2-3 students**
 - **Depending on the size of the project group, corresponding complexity of the project and clear division 'who does what' is required and expected.**

Final Project (2)

- The project should have research flavor (so no survey for final project)
- You are encouraged to
 - develop new algorithm/protocol and/or application and/or
 - improve existing algorithm/protocol/ application and
 - validate via comparative simulation or real implementation
 - run QoE experiments on Video 360 and other IoT data
 - develop analysis tool for public IoT data
 - evaluate/measure existing multi-modal IoT system/tool
 - Evaluate existing analytics tools on existing IoT data
 -

Project Proposal Format (1)

■ Format:

- ACM format, single column, font 11 Arial (or Times New Roman), pdf
- Specify name, title, class number
- Length: 2-3 pages;

■ Proposal: **Introduction**

- Motivation and description of problem
 - explain why it is a problem
 - How did others solve the problem?
 - How do you plan to solve the problem?
 - What is broader impact of your solution?

Project Proposal Format (2)

- Proposal: **Possible Approaches** you consider to take
 - Picture of framework/architecture you want to explore
 - Algorithm you want to explore and compare/ improve
 - Experiment(s) you want to conduct
- Proposal: **Action Plan**
 - By when you want to do what?
- Proposal: **References**
 - Papers you want to read and use in your research (at least 3 references must be included – read related work before you propose a project)

Project Presentation and Report Formats

- **Presentation format** should be similar to the lecture format
 - Talk about your problem, challenges, solution and validation.
 - Conclude with lessons learned
- **Report format** should be written like a scientific conference/workshop paper in ACM format (available on web)
 - Read and review papers carefully

Project Deadlines

- **Project Proposal: October 4 (Monday), 11:59pm**
 - Submit to klara@Illinois.edu
 - Subject: cs537: Project proposal
- **Meet with Instructor for Project Proposal feedback:**
 - October 12 and 14, 4-5pm (Office Hours)
 - October 13: 1-3:30pm, 4:30-6pm
 - October 14: 8-1:30pm
 - Sign-up sheet will be provided

Project Deadlines

- **Project Presentation: November 30, December 1 and December 7**
 - Sign-up sheet will be available
 - Depending on number of project, time slots will be allocated
 - Depending on number of students in the class, number of project in the class, we will inform each group about the allotted presentation time.

Project Deadlines

- **Final Project Report** Deadline: **December 15, 11:59pm** (Wednesday)
- Depending on the size of the project group
 - 1 person project: min **6 pages** – double column ACM Format paper (with references, pictures, tables)
 - 2 person project: min **8 pages** – double column ACM Format paper (with references, pictures, tables)
 - 3 person project: min **10 pages** – double column ACM Format (with references, pictures, tables)

Facilities and Equipment

- Engineering workstations-linux machines
- Use laptop cameras or mobile phones cameras or just images/videos on Internet
- Software: **gstreamer, ffmpeg, GPAC, kvazaar (HEVC encoder), MATLAB, Jupyter Notebook, Phyton, Graphana, MQTT** (and other pub/sub systems), other IoT and vision software packages
- If you have any further questions regarding the software, please, contact the TA
 - More software can be installed based on project demands – email for help to engrit-help@illinois.edu (and TA)
 - Any problems with engineering workstations/multi-modal software – email for help to engrit-help@illinois.edu (and TA)

Grading

- **Take-Home Midterm Exam**: 21 %
- **Paper #1 Presentation** : 10 %
- **Paper #2 Presentation**: 10%
- **Paper – Three Reviews**: 9% (each review 3%)
- **Final Project** : 50%
 - Project Proposal (5%)
 - Project Presentation (18%)
 - Project Final Report (27%)

Grading policy

- Gradebook system: TBD
- Late policy
 - 3 Bonus Days for Review posting!!!
- It is your responsibility!
 - Check announcements in lectures, campuswire, or class website
 - Please, email to TA and/or instructors

Re-grading policy

- Students have **1 week** (after the grade is released into the compass 2g gradebook) to request for re-grading
- Re-grading requests need to be in **writing** to the instructor/TA
- After the re-grading period, **no** re-grading request will be granted.

Summary

- Any questions you may have, please, email to
- Instructor : klara@illinois.edu
- TA: ayushs2@illinois.edu
- **Have a great semester Fall 2021!**