

CS536 Final Course Project (Fall 2023)

Total points: 150 points

Project Proposal Due: 23:59:59 PM, Sep 29, 2023
Project Presentation/Demo Due: 23:59:59 PM, Dec 4, 2023
Project Report Due: 23:59:59 PM, Dec 8, 2023

1 Pick your project topic and team

The final course project is **TEAM**-based. A team of up to **THREE** students can work on one course project. Each team pick one topic out of the following topics in any category.

Category 1: Building New Internet Applications

In this category, a team expects to

- Pick ONE application;
- Implement its client and server (source codes must be submitted as part of the project);
- Deploy the developed application for a field test.

Note: the recommended field test is to (1) run the server at a public place (say, Cloud or the department server) or the lab server provided by the instructor (you need to contact cs536-ta@cs.purdue.edu at least 3 weeks ahead of time). (2) deploy the client at a smartphone or a device (based on the developed app) and (3) test with real network environment (say, campus wifi and/or 5G/4G networks).

- Evaluate the performance in various experiments.
- **(25 points: new design)**. Please propose at least one design algorithm to improve application performance in real networks. Please implement your design and evaluate the new design compared to the above benchmark.

Note: the above basic items (except the new design) takes 125 points out of 150 points.

- **(Bonus: up to 50 points)** Conduct an in-depth research project which extends the above efforts and target at a paper submission. If the team wants to go for this BONUS option in the final course project, the team must tell us as soon as you can, **no later than Oct 30, 2023**.

Please pick ONE out of the following project topics in Category 1:

- **1a. WebRTC**. Please use webRTC to implement real-time communication and customized capabilities to your application that works on top of an open standard. Reference: <https://webrtc.org/>.
- **1b. Video live upstreaming**. Please develop a live upstreaming application on your phone, which will stream the video captured by the phone camera to the remote server in real-time.
- **1c. ChatGPT-on-phone**. Please develop a mobile app that works with ChatGPT to build a chat robot. The app must use human speech as the input and the output (note that you need to use speech-to-text and text-to-speech technologies).

- **1d. Define your own one.** Any team is encouraged to pick any application other than the above three based on your experience and interests. If the team wants to go for this option in the final course project, you need to get an approval before you submit the proposal as soon as you can, **no later than Sep 22, 2023**.

Category 2: New Solutions for Emerging Networking Problems.

In this category, a team expects to

- Pick ONE problem,
- Learn the state-of-art techniques and related work; Formulate the problem with a network system model;
- Develop a solution (likely an algorithm) to solve the formulated problem.
- Implement the proposed solution and evaluate how it performs.
Note: the above items takes 125 points out of 150 points if your implementation and evaluation is based on simulation.
- **(25 points: real implementation and evaluation).** You need to implement, deploy and evaluate the designed solution in a real network environment. (Please refer to the above recommended field test).
- **(Bonus: up to 50 points)** Conduct an in-depth research project which extends the above efforts and target at a paper submission. If the team wants to go for this BONUS option in the final course project, the team must tell us as soon as you can, **no later than Oct 30, 2023**.

Please pick ONE out of the following network problems in Category 2:

- **2a. Bandwidth allocation for multi-stream video analytics.** N cameras capture the video and stream the captured video to ONE edge sever which runs a video analytical task (for example, object detection over deep-neural-networks). The accuracy of the video analytical task is impacted by video quality (say, the accuracy is higher with a higher video resolution). However, the higher video resolution consumes more network bandwidth. In this multi-stream video analytics scenario, we assume that the total network bandwidth is not sufficient to achieve the highest accuracy for all N streams. Given this, please design an algorithm to allocate network bandwidth among multi-stream. Note, in this project, you need to handle time dynamics where video frames vary over time (say, 30 fps) and the video analytics accuracy varies over video frames.
- **2b. Multi-TCP for ultra-reliable low-latency video live streaming over WiFi and cellular networks (5G/4G).** HD Video (4K resolution or above) captured by a smartphone camera are streamed to the server either via WiFi and cellular . Please first implement a basic Multi-TCP solution to support video streaming over both WiFi and 5G. Please evaluate its performance compared to (1) single TCP over WiFi and (2) single TCP over cellular. Please design a new algorithm to improve multi-TCP over both WiFi and cellular. Note that multi-TCP works like single TCP if WiFi is not available.
- **2c. Define your own one.** Any team is encouraged to pick any application other than the above three based on your experience and interests. If the team wants to go for this option in the final course project, you need to get an approval before you submit the proposal as soon as you can, **no later than Sep 22, 2023**.

Category 3: Reproducing a Recent Top Publication

In this category, please pick one paper out of NSDI'23, MobiSys'23, SIGCOMM'23, and MobiCom'23 to reproduce. You are encouraged to pick the one with open source codes.

- Pick one paper to reproduce,

- Learn what have been done by the authors (particularly, open source codes and datasets),
- Reproduce main results presented in the paper. You can choose to reproduce the figures/results presented in this paper.
- **(Extension: 50 points)**. Please propose the extensions the team plans to do after reproducing this work. For example, the team runs experiments in more network scenarios and generate new results beyond those in this paper, or the team implements new design variants and evaluate how they perform.

Note: the above items (except extension) takes 100 points out of 150 points if source codes are ready to use and can generate all the results presented in the paper. The team must indicate whether they want to do extra extension work for 50 points and list the proposed extensions for an approval. If so, please do it as soon as they can, **no later than Oct 30, 2023** (Please get an approval before Nov 6).

Category 4: Define Your Research Project

In this category, a team can propose ANY Research project which is relevant to computer networks. You are highly encouraged to work on the project at the intersection of this course and your true research interests/program. You need to submit a 2-page proposal (including problem statement, planned actions, delivery goals, timeline, how to evaluate your project) to get an approval from Prof Peng.

You are encouraged to schedule a meeting with Prof Peng to get her early feedback on your project ideas before you submit the proposal. It is proved to save your time and reduce the risk without getting my approval.

Please submit your proposal no later than **Sep 22, 2023** (approval by Sep 29, 2023). NOTE that the proposal deadline in this category is 1 week earlier.

2 Part A: Project Proposal

Please submit a project proposal to Gradescope. Please include (1) project topic, (2) team and (3) proposed items and other necessary information needed for the project that the team picks.

3 Part B: Run Your Project

Please start early. Please run your project as you plan. But in case you need to make changes, please do not hesitate to contact Prof. Peng.

4 Part C: Presentation and Demo

Please submit all the source codes (if applicable) and presentation/demo. Please record your presentation submit a 15-min video presentation (including demo if applicable).

More instruction on how to submit will follow (announced at Campuswire).

5 Part D: Final Report

Please submit a report with no more than 6 pages. You are encouraged to use Latex to edit your report. Please use the template from ACM (<https://www.acm.org/publications/proceedings-template>). For Latex users, please use `documentclass[sigconf,10pt]{acmart}`