

Project report for CS120: Computer Network

Guorui Cui

Yihang Liu

From SIST of ShanghaiTech University

0. Abstract:

This comprehensive report explores the challenges faced by our team in the computer network course and provides an in-depth analysis of strategies to improve project management, collaboration, and guidance from the teaching team. The challenges range from confidence issues and time management difficulties to communication barriers. The proposed strategies are designed to not only address these challenges but also create a conducive environment for successful project completion. Additionally, recommendations for increased guidance from the teaching team are presented to foster a more supportive learning experience.

1. Technical Challenges and Solutions:

1.1 For Project 1

In project 1, we are asked to config a physical layer by ourselves.

The issue here is to improve the bandwidth as much as possible while maintaining the channel to be reliable enough. The approach we take is split the range of frequency in to K intervals. In each frequency interval, we have S states, so in theory, and use the old school FSK to encode the information. As a result, we have S^K possible symbols per time slice, by tuning the size of K and S we may reach a high frequency.

One of the key challenges here is that the result of FFT sometimes is not satisfying enough, we usually get some frequency deviation due to the fact that it is in practice impossible to align the sample time slice with the real signal time slice. We solve this issue by cut the edge of the sampled time slice and only do Fourier transform on the inner slices. This results in a better frequency domain behavior.

To detect the Chirp signal, we sample a bunch of time slices adjacent in the time domain and do Fourier transform on each time slices to see whether the maximum energy frequency is increasing at an expected rate and start receiving the signal once the frequency reached our expected frequency.

To solve the problem of errors in the channel, we use self-correcting codes to ensure that the signal can correct itself. About 20% channel capacity, however, is given up during this process.

1.2 For Project 2

For project 2, we need to write MAC layer, to connect MAC layer and physical layer together, and we also need to achieve communication with each other via handshakes.

This project is much easier than project 1, but we start it too late, so we didn't finish it on time, which we will mention later.

In this project, one of the challenges comes from the transmission among different finite state machines. We need to right correct conditions.

We also need to set signals, such as TxPending flag, TimeOut signal, Tx_Done signal and so on, carefully. One little mistake will lead to huge failures. Those signals play pivotal roles in orchestrating a seamless and error-free communication process. The significance of these signals lies in their ability to convey essential information, coordinate timing, and ensure the synchronization of operations within the MAC layer.

And we also facing mitigating issues related to signal timing mismatches, varying processing speeds between different components, or delays in the overall system. We build buffers to deal with those issues, such as receive buffer and transmit buffer to buffer the signals.

1.3 For Project 3&4

Unfortunately, we didn't finish project 3&4.

Since the later project depends on previous one, we could not start it before the previous projects were done.

A little suggestion here is that may be the teaching team can provide the referred code every time after one deadline of one project. Not just providing the code of project 1&2 after the deadline of project 2.

We will tell you the detailed story later.

2. Our story:

In here, we need to introduce our backgrounds to you guys, so you will have a more clearly understanding for the story we will talk in the following content.

Our team is composed of 2 members, both of us are senior undergraduate students in SIST of ShanghaiTech University, and we just finish our 3+1 program from the University of California at Berkeley, so we are not so familiar with the situation of our home university. So, basically, we choose this course hastily.

We will tell our teams respectively.

One person in our team is the god in coding world, who is very famous, and earned a lot of

reputation from other schoolmates. He chose this course because he thought he could learn a lot from this course, and he also underestimated the difficulty of this course by mistakes. He also took other difficult courses in the same time, and he need time to apply for graduate school.

The other one is EE major, who choose this course since his “good” schoolmate told him this course is very easy, and quitted this course without telling him before the adjustment window was closed. So, he unfortunately chose this course. And he also underestimated the difficulty of this course, since he thought he had already learnt the theory knowledge of this course, it should be easy. He chose this course just because he recognized this course as an easy elective course across disciplines to fulfill graduation requirements.

3. Challenges:

Our team embarked on a challenging journey in the computer network course, tasked with completing four demanding projects. Despite successfully overcoming the initial hurdles in the first project, the team encountered confidence issues and grappled with various aspects, including time management, communication barriers, and external time constraints.

The completion of the first project, while triumphant, was marred by missed deadlines, leading to a subsequent loss of confidence within the team. Addressing this issue is critical to ensuring the success of future projects.

Our team also struggled with effective time management, resulting in the failure to complete the remaining three projects. Conflicting schedules and challenges in coordinating collaborative work during weekends added to the complexity, which leads to our failure finally.

Furthermore, the communication barriers within our team have posed significant challenges. These barriers have manifested in various forms, creating impediments to seamless collaboration. In particular, issues related to online platforms and timely responses have been notable sources of disruption.

The reliance on online communication platforms has proven to be a double-edged sword. While they offer convenience and flexibility, they have also introduced challenges such as delayed message delivery and the potential for misinterpretation. The asynchronous nature of online communication has sometimes led to misalignments in understanding project requirements and milestones.

Timely responses have been a critical factor in maintaining effective collaboration. Unfortunately, our team has encountered difficulties in ensuring prompt replies to messages and queries. This delay has had cascading effects on our ability to share timely progress updates, discuss intricate project details, and address emerging issues before they escalate. These communication challenges have been particularly impactful in our collaborative

efforts. The lack of instantaneous communication has hindered the real-time exchange of ideas, resulting in a less agile and responsive team dynamic. As a consequence, our collective decision-making processes have suffered, and the overall cohesion of our team has faced challenges.

What's more, being senior undergraduates with additional commitments, such as graduation projects and graduate school applications, added external pressures. This limited the time available to dedicate to the time-consuming computer network course projects. The project requires us to spend 1/4 time of the whole semester is really suffering.

Moreover, since we don't have any guideline of the project, the choosing of programming language becomes a huge challenge facing us. We use Go programming language firstly. Since one of us uses Windows system, and there are some issues when running Go in Windows, we have to change language, and start to learn a new language again. Then we changed to Java. And translating what we done before to a new language. Facing unfamiliar APIs, we met some troubles, and didn't know where to start, or what could we use to accomplish a task. Also, we only had requirements in the description of projects, which is more abstract than courses we contacted before.

Even having the referred code of project 1&2, we were not able to run it, since the library used in it didn't support Linux easily. And recoding it is a time-consuming thing.

4. Proposed Strategies:

A retrospective analysis of the successful completion of Project 1 is recommended. This analysis will identify both strengths and weaknesses, helping to create a roadmap for tackling subsequent projects. Additionally, organizing team-building activities will foster a positive mindset and strengthen team bonds.

To address time management challenges, the team should establish a shared calendar that clearly indicates each member's availability. Realistic project timelines and deadlines, regularly reviewed and adjusted based on project progress, will contribute to better time management. The creation of dedicated time slots for individual and team-based work will ensure a more structured approach.

Improving Communication is also needed. Efforts to enhance communication involve the adoption of instant messaging platforms for timely and efficient communication. Establishing a routine for checking messages, providing timely responses, and scheduling regular virtual meetings to discuss project updates will contribute to better overall communication.

What's more, balancing priorities involves a strategic approach to task prioritization based on project deadlines, graduation project requirements, and graduate school applications. Allocating dedicated time slots for both individual and team-based work will contribute to

maintaining a balanced workload.

5. Recommendations for Project Facilitation:

5.1 Increasing credits from 4 to 6

This course undeniably warrants an increase in credit units, ideally to a 6-unit course, given its level of difficulty and the considerable time investment it demands. The nature of the projects assigned here is truly comprehensive, requiring us to embark on a journey of problem-solving without any predefined guidance. The depth and complexity of the tasks assigned exceed the typical expectations for a standard credit allocation.

The projects in this course are not merely assignments; they are immersive challenges that demand a profound understanding of the subject matter and the application of critical problem-solving skills. Unlike conventional projects, which may provide detailed instructions or templates, these tasks require us to navigate uncharted territories and develop solutions independently. This elevated level of autonomy and complexity inherently justifies an adjustment in the course credit.

The substantial time and effort invested in tackling these projects highlight the need for a more substantial credit allocation. The intricacies involved in researching, analyzing, and innovating solutions demand a depth of engagement that surpasses the typical workload of a standard course. The additional credit units would not only recognize the heightened difficulty but also incentivize students to commit the necessary resources to excel in this challenging academic endeavor.

Moreover, the skills cultivated through the independent problem-solving approach in this course are invaluable. They extend beyond the immediate academic setting and contribute significantly to our overall growth and proficiency in the subject matter. Recognizing the rigorous nature of the assignments and the comprehensive learning experience they provide, it is reasonable to advocate for a 6-unit credit designation for this course.

5.2 Increased Guidance from Teaching Team:

Acknowledging the need for increased guidance, the team should actively seek regular check-ins or progress meetings with the teaching team. Advocating for more detailed project guidelines and supplementary learning resources will provide a clearer roadmap for project execution. Additionally, the proposal of a mentorship program and encouraging peer collaboration within the class will create a supportive learning environment.

5.3 Workshops and Training Sessions:

The team should advocate for specialized workshops or training sessions that focus on the technical aspects of the project. Requesting extended office hours for the teaching team

and arranging periodic Q&A sessions dedicated to addressing project-related queries will provide additional avenues for support and clarification.

6. Expected Outcomes:

6.1 Increased Project Completion:

The implementation of the proposed strategies aims to revitalize team confidence and enhance time management skills, contributing to the successful completion of all projects.

6.2 Enhanced Collaboration:

Improved communication and shared schedules will foster better coordination for collaborative work during weekends, leading to increased project productivity.

6.3 Maintaining Academic Focus:

Strategic balancing of priorities will ensure that the computer network course aligns with graduation project requirements and graduate school application timelines, maintaining a focus on academic success.

7. Conclusion:

In conclusion, this report identifies and analyzes the challenges faced by the team in the computer network course. The proposed strategies, encompassing confidence-building measures, effective time management, improved communication, and recommendations for increased guidance from the teaching team, aim to create a holistic approach towards addressing these challenges. By implementing these strategies, the team seeks not only to overcome obstacles but also to ensure the successful completion of the computer network course projects. This comprehensive approach aligns with the team's commitment to achieving academic success amidst external time constraints.