

This statement of purpose is intended for use with my application to the Philosophy of Doctor graduate program at the Department of Computer Science, Cornell University. This document starts by portraying my education background, both the Bachelor and Master's degrees. Then, it briefly states my professional experience and explains my research experience during my Master's degree study. Then my interest in Cornell's teaching and research is elaborated and finally my future plans after graduation are described. After finishing reading this statement of purpose, the committee will learn why I am qualified to be an excellent student of the program, what motivates me to pursue the doctoral degree at Cornell and why it is so important for my future profession that I earn this degree.

During my undergraduate study, in addition to a number of Electrical Engineering subjects, I studied a wide range of mathematical subjects including four Calculus courses, a course on Probability, and another on Linear Algebra and Complex Numbers, all of which are basic principles of Computer Science. Moreover, I passed two courses on computer programming, data structures and algorithms, which are the knowledge crucial to a successful computer scientist. However, during the first three years of the study, although I enjoyed learning the subjects, I was so shiftless and unmotivated that I did not pay much attention to my academic records. Not until the beginning of the forth year did I decide to boost my GPA as I was conscious that after that year I had to apply for a job and the currently low GPA would preclude me from competing with other students. This consciousness encouraged me to attend classes more frequently, pay more attention to the study materials, and better prepare for the examinations. As a result, my semester GPAs of the forth year were able to stay in a good standing until I graduated. Unfortunately, the total GPA was unable to increase much and remained at 2.49/4.00.

After graduation with the Bechelor of Electrical Engineering degree, I had to apply for a job to earn a living and support my family. I had worked for three companies until I settled my career at Aeronautical Radio of Thailand or Aerothai, a state enterprise under the Ministry of Transport, Thailand. One of Aerothai's principal missions is to provide air navigation services or air traffic control within Thailand's airspace. Specifically, the department of air traffic data systems engineering is responsible for the provision of data systems that support air traffic controllers' operations efficiently and continuously. At the department, my colleagues and I design, configure, and implement those systems by taking advantage of enterprise-graded information technology products, mostly of the USA, such as HP and Dell servers, Oracle and Microsoft databases, Cisco network equipment, and VMWare's virtualization technology, etc. Therefore, I have witnessed how these innovative products help transform air traffic data systems into more reliable and efficient systems. This hand-on, seven-year experience allows me to learn practical aspects of enterprise information systems with our safety-critical applications, and makes me interested in computer science, a core foundation of computer-related products and services. Moreover, the exposure to these technologies encourages me to plan to further my study in the US.

Not long after I started work for Aerothai did I decide to continue my education to the Master's degree in Computer Science at the Department of Computer Engineering, Chulalongkorn University. I had the following three main reasons. First, as a computer systems engineer, studying computer science would give me a professional advantage in terms of the received degree and knowledge. Second, this thesis-based curriculum would allow me to gain research experience in computer science, which would be crucial to my PhD study in the future. Third, in this program, I would have a chance to study a wide range of computer science subjects from Theory of Computation and Computer Algorithms to Computer Networks and Distributed Systems. During the study, I worked hard on studying materials, undertaking term projects and making progress toward my thesis work. As a result, I was able to earn a very good GPA of 3.75/4.00 in the Master's degree with the complete thesis titled "Distributed Time Synchronization for Wireless Sensor Networks".

My decision to pursue the Master's degree was correct because I gained a lot of valuable research experience there. At the department, I was a member of the Ubiquitous Network laboratory under the supervision of Associate Professor Dr. Chalermek Intanagonwiwat, who was also my advisor. At this lab, I learned at least three priceless lessons of research experience. First, I learned how to give academic presentations and to provide productive comments and feedbacks. Every week, one student was scheduled to present an academic paper of his or her interest and another was scheduled to present the research progress of the selected thesis topic. Lab meetings encouraged this process of academic presentations and discussions that benefited not only the presenters but also the audiences. Second, I learned how to work on a thesis research project with my advisor. Every week, I also had to meet

with him in order to report my progress toward my thesis and then had to go back and work on his suggestions and directions. I remember he once taught me that "I might be an expert in the field but not on the topic on which you are working. We need to learn together along the way until we reach the destination." This statement encouraged me to believe in my own research potentials and commence doing research since then. Third, I learned how to prepare a high-quality academic paper to get accepted for publication in academic conferences and journal publishers.

During the years of study at the Computer Engineering Department, I published two academic papers - one in an international conference's proceedings and the other in an ACM journal. When I prepared to submit an academic paper for the first time, I had to do three main tasks. First, I reviewed most prominent papers related to my topic and as I was reviewing, I learned the ideas of leading researchers in the field on the topic and how they presented them in the papers. However, I needed to come up with my own ideas, design my own solutions and compare my work with others'. Second, I needed to turn the ideas into the code implementation in a sensor network platform. Third, I had to explain and organize everything I had learned in an academic paper. According to my advisor, a high-quality paper should not only allow the readers to understand the overall picture of the work, but also enable them to implement it into the code themselves. Therefore, I explained the data structures, algorithms, and communication packets so clearly that one could use all this information for further experimentation. As a result, our paper titled "Energy-Efficient Gradient Time Synchronization for Wireless Sensor Networks", was accepted for publication. In the paper, we designed an extended version of gradient time synchronization protocols that was more time-accurate and energy-efficient, while maintaining a "gradient" property. With the gradient property, geographically adjacent nodes are able to maintain minimal synchronization errors.

In the other paper, all the co-authors had different tasks to finish, such as literature review, performance evaluation, and mathematical proofs. I was responsible for the introduction and related work parts. Our dedication and collaboration as well as the journal reviewers' valuable comments all played important roles in strengthening this piece of work. As a result, our paper titled "Desynchronization with an artificial force field for wireless networks" was accepted to publish in ACM SIGCOMM's *Computer Communication Review*. The desynchronization problem is analogous to a resource allocation problem in which nodes cooperate to take turns accessing to the same resource. In this paper, we provide a prove of convexity of this problem. Additionally, we design a desynchronization protocol, inspired by electromagnetic force field, that performs in a distributed manner, better scales with network sizes and densities and produces less desynchronization errors. Even after graduation, my interest and ambition to do research never abates. In 2013, I had a change to work on a research project with Associate Professor Dr. Teerasit Kasetkasem of Kasetsart University. In this project, we used a signal processing technique to track a moving object in a field given binary sensor observation. In this paper, I was fully responsible for the manuscript preparation and partly for experimental simulation. Finally, the paper titled "A Moving Object Tracking Algorithm Using Support Vector Machines in Binary Sensor Networks", was finally accepted for publication, marking my third publication.

I desire to advance my study to a PhD in the US because of the following three main reasons. First and most importantly, I want to be a professional researcher in computer science in the future, either in an academic institution or in a research laboratory and a doctoral degree is an important precursor to the research profession. Second, I agree with Matt Welsh, previously a professor of Computer Science at Harvard University, about a PhD study. He suggests that "You get an intense exposure to every subfield of Computer Science, and have to become the leading world's expert in the area of your dissertation work." For example, during my PhD study, I will have an opportunity to get exposed to a variety of academic subjects and research projects in computer science, such as Artificial Intelligence, Computer Graphics, Robotics, Databases, Systems, Software Engineering, Computational Science, etc., all of which will considerably expand my intellectual horizons in computer science. Moreover, the PhD study will train me to be an expert in the field of my dissertation through the educational systems and processes, together with my assiduous and persevering efforts. Third, I am conscious that studying at a PhD level requires an academically vibrant environment which includes surroundings with brilliant students and faculty members, as well as accessible academic conferences and seminars. In my opinion, all of these are prevalent in the US educational systems and universities.

I aspire to become a PhD student at Department of Computer Science, Cornell University, a presti-

gious university in the US, because I am particularly interested in its teaching and research. To begin with the teaching, Assistant Professor Nate Foster's Network Programming is of my particular interest because network programming is a skill that I need to master in order to be a competent computer network researcher in the future. Network programming is distinctive because it entails several modules and components from application layers down to MAC and physical layers. Moreover, it is difficult to debug network programs because distributed nodes are connected by error-prone and latency-inducing communication links. Moreover, the "Seminar in Programming Languages" course will provide me with hands-on programming skills that are essential for my researcher career. Additionally, Associate Professor Emin Gn Sirer's Operating Systems course is also an interesting course that educates students with theoretical and practical aspects of operating systems. Operating systems are indispensable middleware of today's computing systems that links application software with computer hardware. Computer network research often involves modifying or testing low-level abstractions of operating systems; therefore, principles and practice of operating systems will give me a deeper understanding and expertise in computer network research. In addition, "Cornell Systems Lunch" is a seminar that introduces students with novel and recent systems research. I look forward to attending and participating in this seminar because it will teach me to think critically and scientifically during the presentations and discussions.

The following are Cornell research projects that interest me. First, Associate Professor Emin Gn Sirer's publication "On the Feasibility of Completely Wireless Datacenters" proposes a novel networking model of data centers. Instead of attaching to wired networks, in this paper, completely wireless data center networking is investigated and the experimental results surprisingly suggest that it outperforms traditional wired networking in terms of bandwidth, latency, and fault tolerance. During the professional experience with aeronautical data systems, wired networks reduce the maintainability of such systems. For example, when we alter a few network policies, we need to re-configure and re-wire a non-trivial cluster of systems. In completely wireless data centers, re-configuration alone suffices to reflect the new policies. However, more work needs to be further investigated. For instance, how well these wireless networks work in a real data center running particular applications.

Second, Assistant Professor Nate Foster is focusing his research on software-defined networks or SDNs. In my opinion, SDNs are the future of computer networks because it allows network administrators or programmers to control an overall behavior of the network through the control plane while letting the data plane of network devices send and receive packets. Although SDNs pave the way for programming the network, it is difficult to do so because of the complex states and interactions between different network layers. In his paper "Languages for Software-Defined Networks", the authors describe the Frenetic project that aims to ease network programming tasks through higher-level abstractions. From my perspective, computer network researchers must apply formal verification to network protocols and algorithms to make sure that they work correctly and consistently. My research background in computer networks and knowledge of the theory of computation will help me explore and accomplish work in this research area.

Third, Professor Deborah Estrin is working on interesting interdisciplinary research projects. She is bringing back people's digital traces or "small data" that they leave on social networks, emails, and mobile devices. According to her talk at TEDMED 2013, these data can be leveraged to promote their health through an open architecture called "Open mHealth". For example, digital traces of a patient may include his wakeup and go-to-bed time, his check-ins at different locations at different time, and the pictures of his food consumed over the weeks before seeing the doctor. All of these can provide his doctor with more useful and penetrable information than the question "how are you?" and the answer "I am fine". Research questions and topics of this research area are still open. For example, how can we guarantee an agreeable level of privacy for data owners while the data still remain meaningful? How can we analyze or mine such a combination of heterogeneous data such as texts, photos, temporal and spacial information? How can we display or visualize these data so that doctors can interpret or understand them easily? This novel research area which combines healthcare and data analytics will make a tangible and beneficial impact on not only research communities, but also people in general, including my ageing parents.

My plan after graduation with a doctoral degree is that I will look for a research or post-doc position that is related to the field of my dissertation in order to continue to accumulate research knowledge and experience. Therefore, within five years after graduation, I will become a real expert in the field and plan

to lead my own research laboratory. Research experience gained during the PhD study and accumulated after graduation will play an important role in attracting funds and research students into my lab.

I would like to express my appreciation to the admission committee of Cornell University for taking my statement of purpose and other application materials into consideration. I hope that the committee will be convinced that my educational background, academic and professional experience, and research motivation and ambition are sufficient evidences to suggest that I will be an excellent student of the PhD program and a competent researcher in computer science.