INTERVIEW WITH DR ALVIN CHAN
By Carmen Au

C: Could you share with us your educational background?
A: I spent most of my education years in Singapore. Instead of opting to advance towards college education, I decided to pursue a diploma in Electronics and Communications at the Singapore Polytechnic. After completing the diploma, I went to the National Service and spent two and a half years in the army. Then, I decided to go to UK for my undergraduate study in Electrical and Electronic Engineering at Leeds University after releasing from the Service. Later I made a change to Computer Sciences for my PhD study at the University of New South Wales in Australia.

C: Before you joined PolyU, what did you do about research?
A: My research focused on transport protocol in networking during my PhD study and I was attracted towards networking research at the physical and data link layers after graduation. During the mid-90s, the advancement of ATM (Asynchronous Transfer Mode) technology and the significant research funding for this area, had presented research opportunities for me to design and develop MAC protocols for wireless ATM, as well as developing state-of-the-art OFDM (Orthogonal frequency-division multiplexing) technology that can drive wireless data rate to above 25Mbps (quite an achievement in those days). After spending several fun and rewarding years in the industry in Australia and Singapore, I decided to join the academic that led me to take up a position at PolyU.

C: Could you summarize the research you have done after joining us? And your current work?
A: Due to the lack of equipment setup and instruments in the department, after I joined COMP, I soon realized that I needed to change my research direction from those hardware dependent to software-oriented. This has led me to explore research opportunities in software engineering that bridges between what the application needs but is lacking in the network infrastructure. The aim is to explore and investigate software abstraction techniques that hide away the complexity of dealing with low level interactions among distributed components, while facilitating ease of software development and maintenance.

Currently, I am researching into elastic application framework for pervasive computing. The ideas comes from the observation that we are surrounded by many smart phones, embedded devices, computers and even smart appliances that operate autonomously with little or no interaction among them. In a way, these devices are like cloudlets that not only provide computing facilities but also sensing, storage, and various input and output modalities. The central theme of our research is to develop applications that are elastic so that components of applications can be elastically deployed on these devices to improve and enhance user's experience. The result of this work will directly impact how mobile services, embedded devices and appliances may collectively participate in resource sharing and their integration to the wide-scale cloud services.
C: You have done very good work on mobile middleware, could you share it with us?

A: The wireless has lots of imperfections and the application is directly connected to the network. This has led to the rise of middleware which hides the complexity of network interactions among components and devices, and hideaways the imperfection of the network environment. Then, I started to explore research in applying middleware to mobile computing, which presents many interesting issues and challenges such that middleware may play an important role. We have worked on how the application could adapt to the not so ideal environment but the user could still continue to enjoy the certain level of quality of service. This has led me to look into context awareness that focuses on how we could make use of the contexts around our environment. It allows the middleware to make better adaptability if all the contexts can be captured. As a natural progression, we have begun to explore how middleware could be extended to cloud and how cloud could be integrated to middleware. With pervasive computing that is comprised of many embedded devices, the idea of integrating these resources as “cloudlets” being extended peripheral clouds is both interesting and challenging from the perspective of resource management.

C: And, your insights or major trends in this field?

A: As wireless communication technology continues to grow, coupled with the pervasive use of mobile devices, there is a need to develop smart environment where mobile and fixed devices can seamlessly discover and share contexts and resources to create elastic cloud environment. I believe middleware may play an important role in providing a platform where mobile applications (or other applications for that matter) need not be bound to a mobile device. Therefore, a different paradigm should be explored. The application should be bound to the person and the environment. Software should not be just installed on the device, however, it should be elastic, meaning environment-oriented rather than device-oriented. For example, on entering the room, the middleware may automatically discover several resources or devices that the application may leverage to better improve user’s experience in using the application. So far we do not have any names for such technology, we may think about the name of elastic software, immersive computing or immersive application.

C: What are your main techniques and contributions in this field?

A: Middleware is quite a broad area that covers anything from low-level message passing to large-scale cloud services environment. As such, I am quite mindful of not stretching myself too thin by trying to do too many things with the limited resources that I have. So far, my contributions have been in the area of applying middleware techniques to address challenges in a mobile computing environment. More specifically, I have been working on applying various adaptive computing techniques to mobile application development. This has driven me to explore adaptive architectural model and modeling techniques for programming adaptable mobile applications. In addition, I have been doing some research works that focus on modeling contexts in a pervasive environment. This is particularly challenging since we aim to develop a model that can richly capture contextual data so that it can be discovered, processed, interpreted and, if necessary, bound and composed with other contexts to form new knowledge pertaining to the environment. Accurately capturing the user and surrounding contexts will be paramount to enabling mobile middleware to make timely and effective decisions during the adaptation process.
C: Do you have collaborations with colleagues?

A: Yes, I do have past and present collaborations with colleagues in the department, for example, Jiannong, Keith, Hareton, Hong-Va, Grace and Stephen. In a way, software engineering and middleware technology are established engineering approach to software abstraction that can be applied to other disciplines such as HCI and biometrics. Modern research demands cross-disciplinary collaboration that calls for effective leverage of individual talents. Often during discussions, I am intrigue by the diversity of knowledge and creativity that my collaborators demonstrate that often steered us to address the research challenges from a different perspective. I am glad that the department is establishing research funds to promote such synergistic collaborations.

C: What are your plans for future research?

A: In the future, I plan to strengthen collaborations among colleagues and also with external researchers, especially in China. The agglomeration of expertise and strength from across researchers with multi-disciplinary knowledge and skills will enable us to work on projects that not only allow us to capture empirical data in our experiments to validate and develop working prototypes, but also create research impact that is beyond theoretical modeling.
C: Could you share with us your educational background?

K: I received my BEng degree in Computer Engineering, which was jointly organized by the Department of Electrical and Electronic Engineering and Department of Computer Science, and PhD degree in Computer Science from the University of Hong Kong. At first, I applied for the MPhil, but my supervisor transferred me to the PhD programme after one and a half years.

C: What are your research interests?

K: My research interest is mainly Databases, especially spatial and mobile databases. Recently, I have also worked on some privacy and outsourcing related problems for databases. Spatial databases are used to capture some location data, the objects are assigned with some locations and people want to issue queries like range queries or nearest neighbor queries.

C: How did you get into your main area, Databases?

K: In fact, I chose a research field other than Databases at the beginning I applied for MPhil study, but there were no places and I was on the waiting list. At that time, I were still not sure I would go to the industry or do research study, after some time, I got the place because some better candidates joined the industry. I was assigned to be a student of Prof. Nikos Mamoulis who was an Assistant Professor at that time with research interests in Databases and Data Mining.

In the beginning, Prof. Mamoulis gave me a research problem on data mining. We had worked on that topic and also published a paper. However, I found that I was not interested in that. It is because you have to explain the significance of the result on real dataset for the data mining problems. Later, I worked on some optimization problems in the context of spatial database and I have become interested in this area. For example, the goal is to solve a well-defined problem efficiently.

C: Could you share the insights or major trends in your field?

K: There are some major trends in the Database research field. Two topics are quite popular nowadays, one is Cloud Computing and another is Crowdsourcing (using people to solve particular problem). I am interested in these two big areas but I have not worked on them yet.

Crowdsourcing can help solve some problems that could not be expressed easily in the past. We may want to use some people to help in certain problems which may not be easily answered by machine. Some related works have talked about how to do it efficiently.
C: Could you tell us about your current research?

K: I have worked on some problems related to privacy, security and outsourcing of data since last few years. One example is the location privacy, which allows you not to reveal your own location when searching the nearest target. This is the privacy preserving query. Another is the security of the query result. Sometimes the search engine may not return the actual result as it may be sponsored by others. I am working on this kind of problems in the context of spatial database. Currently I have a project related to the security aspect on shortest path query, meaning that the service provider needs to provide some kind of proof in order to verify the result.

I am also working on the outsourcing problems. We may outsource the data storage and data transmission to the service providers without revealing the contents of data to them. We can use some encryption and transformation techniques to solve the problem. One solution is to use cryptographic, but this method is expensive. Data is partitioned and encrypted individually, and can be decrypted individually when retrieving from the service provider. Another method is to do some kind of transformation in which the encryption key and decryption key will be related to the transformation itself. The service provider only performs the similarity search of the protected data. In our solution, we will try to do some kind of filtering tasks at the service provider without knowing the meaning of the data. That is very useful for cloud.

C: What is the impact of your research?

K: The privacy and outsourcing issues may generate some impacts. Nowadays, people are more concerned about their privacy. Those famous web sites, such as Google, Google Map or Microsoft Bing, have the privacy statement stating that the query log would not be revealed to others and it would be kept for a certain amount of time, e.g. 18 months. However, it may still be possible for the government to obtain the data in the US. My research is to change such situation to avoid those queries (in the query log) to be revealed in the future.

On the other hand, the outsourcing related problems may generate some impacts in the cloud computing. Nowadays, some companies want to outsource the services to the cloud. We would like to make sure that those outsourcing services are actually doing the task.
C: Could you summarize the core techniques of your research and main contributions?

K: The core technique used in my research on privacy and outsourcing problems is Space Twist which can return the correct result by satisfying the communication cost even the fake location is specified in the location privacy problem. It is the trade-off among the location privacy and communication cost. We have tried to extend this technique in the papers published in the ACM transactions.

My major contribution is optimization problem for spatial searching. I always try to examine some spatial problems that have not been studied by others before. Recently, I have worked on the shortest path caching problem. This is the problem I identified and may be useful for the Google map. In fact, the caching problem is not new, but it is a new research direction for shortest path caching. Finding out a good method for the shortest path query may improve the response time to both the users and the service providers. The service providers may also spend less investment on the resources. Recently, we have a paper on this topic accepted by a conference, SIGMOD.

C: Database is ubiquitous, every other area requires the database technology. Do you have any plans in finding collaborators to expand your research?

K: I will try to find some collaboration in pattern recognition or computer graphics. It is because they may be useful for working on some problems related to similarity search. I have briefly talked with Ajay and Zili. However, we do not have any concrete collaboration for the moment. Zili is working on SSD (Solid State Drive) now and his next step may focus on the storage for next generation. We can work together to find out some database problems that may exploit those devices.

In fact, there is a new research area in Databases on how to exploit new hardware devices to speed up the processing of query. Some researchers have already explored the use of multi-core CPU and GPU (Graphics Processing Unit). GPU can support certain vector operations and the operations can be performed in parallel. Nowadays, people would like to maximize the performance of the machine by considering different aspects such as the CPU cache, hard disk, memory, etc.

Another issue is the energy consumption. Those data centers are mostly concerned about the energy consumption in the long run. It can be more expensive than the initial hardware investment. For some devices, such as SSD, they may provide certain operations using much lower energy than main memory.

C: You have an excellent publication record as a young researcher. Could you share your experiences on how to publish in top journals and conferences? And how you pick up topics?

K: I was lucky to have great opportunities working with scholars from other universities (e.g., in Singapore, Denmark, Australia), especially during the time I stayed overseas. I did learn a lot from them, not just knowledge and skills, but also attitude and passion. Finding a good problem with a good application and some non-trivial challenges is important. We do not need to worry about the remaining task if we have a good problem. On the other hand, reviewers may think that certain problems may not be useful even we have good techniques. We will try to examine whether existing technique can be used to solve that problem directly and also find out the competitors. For those hot topics with many competitors, we need to do better than them if we want to publish the paper. If there are one or two competitors, then it is a new problem. A problem may not be come out immediately. We need to accumulate some information and experiences after reading some papers and talking with other people during the conference. Several ideas will then be come out and we will try to examine the strengths and weaknesses of the ideas. The most promising one will be selected to work as we don’t have many resources.

Apart from picking a good problem, we also try to target at top conferences. In our research area, conferences are more prestige than journals, such as the ACM SIGMOD (International Conference on Management of Data) and the VLDB conference (International Conference on Very Large Data Bases). For journals, I got some papers on ACM TODS (Transactions on Database Systems) which is the top journal in my field. They require both theoretical and practical argument. I published one with my supervisor during my PhD study in HKU. Then I published another one with colleagues in Denmark. After working at PolyU, I tried to extend my previous conference paper with a professor in Denmark and we published that last year. On the other hand, the VLDB journal (Very Large Data Base Journal) and the IEEE TKDE (Transactions on Knowledge and Data Engineering) are not difficult compared to ACM TODS.
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