

# Practices of Mainframe Educational in Tongji University

Jie Huang, School of Software Engineering, Tongji University, Shanghai 201804, P.R. China

Min Wang, School of Software Engineering, Tongji University, Shanghai 201804, P.R. China

Zhen Gao, School of Software Engineering, Tongji University, Shanghai 201804, P.R. China

## Abstract

Despite the fact that mainframe takes a dominating share in the high server market and has great influence in financial, manufacturing, transportation, retailing industries. There's a considerable lack of mainframe professionals, especially the young generations in China and over the world, and the gap between the supply and demand is still widening.

Tongji University, a leading university in China, is one of the pioneers in this field. As one of IBM's educational partner, Tongji is on the way of exploring a suitable way for mainframe education at universities, and up to now some fruitful results have been observed.

**Keywords:** Mainframe education, Chinese University, Large Scale Enterprise Computing, Curriculum building, Cultivation Pattern

## 1. Introduction

Despite the fact that mainframe takes a dominating share in the high server market and has great influence in financial, manufacturing, transportation, retailing industries. There's a considerable lack of mainframe professionals, especially the young generations in China and over the world, and the gap between the supply and demand is still widening.

A real story happening in Shanghai, a leading Chinese bank planned to recruit 10 mainframe application developers in 2006, but they had not received enough applicants half a year later. Outsourcing IT companies like ISSC often complain that the shortage of qualified mainframe professionals has been one of the greatest factors that hinder their expansion plan.

Mainframe education in China is still at an early stage. Tongji University, a leading university in China, is one of the pioneers in this field. As one of IBM's educational partner, Tongji was provided with a IBM eServer System/z900 server, together with a full pack of software in May 2005, and started to build its mainframe curriculum ever since.

## 2. The characteristic of mainframe education

The challenge of building up mainframe education at universities comes from the complexity of the mainframe hardware and software, which makes it a quite different approach from the current open platform based computer science curriculum. We concluded the characteristics of mainframe courses from three aspects:

### 1) Theatrically topics

The knowledge of mainframe hardware architecture, as well as other fundamental concepts, including relational database, programming languages and project management, shares a large

similarity of that in other platforms, they can be inherited from the regular curriculum current taught at universities, but we can have include slides to point out the difference. Those courses including “principles of computer system and architecture”, “operating systems”, “Principles of Computer Organization” , “Database Theories”, “Project Management”, etc.

### **2) Special topics for large scale business applications on legacy platforms**

Though mainframe basic theoretical can be covered in the current curriculum, the application technologies in an enterprise environment can be very strange to students who are so used to the modern way of application and personal computing. Like the critical emphasis on performance, concurrency, security, scalability and reliability. Also students need to learn a number of mainframe skills through several courses before they could start to develop applications on mainframe platform.

### **3) Highly practical**

Mainframe professionals, either application developers or system administrators, are highly practical roles and requires large hands on skills. That’s a point we must carry in mind through out our education. For this point we develop abundant experiments materials for practical courses, from step by step tutoring booklets to case study and project guides.

## **3. Mainframe education in Tongji University**

Our goal is to cultivate service oriented mainframe professionals, to meet the increasing demand from the industry. We put “pioneering, practical and international” into practice throughout the mainframe education, through a complete course settings and practical exercise plans, we motivate the students with the technology, keep at front with close international cooperation, and strive to improve the course quality.

On industry cooperation, we host the “system z mainframe education center (shanghai)”, which is the only mainframe education center in east China; we invited senior experts from industries to conduct mainframe courses, each year we have 3 person/times on average and conducting courses totaling 3 weeks; build intern base camps in IBM Chinese Develop Lab in Beijing for practical trainings for our undergraduate and graduate students, each year we have over 30 students intern or get employed through internship program on mainframe platform; We organizing the Chinese DB2 users group, which serves as a communication platform for mainframe technical professionals from Labs, Universities and industry, and hold Chinese DB2 Users Group meetings/seminars each year from 2007.

On international cooperation, we’ve been cooperating with IBM Silicon Valley Lab on DB2 educational course developing project. Several mainframe courses are taught in English and are also opened to foreign students; The lab experts are invited for short term courses or lectures, and we’re also very interested in probing the possibility of building up cooperation with universities in the US.

## **4. Mainframe curriculum**

We’re currently providing the following courses to both undergraduate and graduate

students in Tongji University.

Course	Category	Credits	Class Hours			Semester	Remarks
			Total	Lecture	Practice		
Introduction to the New Mainframe and z/OS Basics	F	4	64	32	32	3rd	MOE-IBM Model
Enterprise Database Application Development	P	3	48	24	24	5th	MOE-IBM Model Co-developed with SVL
Foundamental of Large Scale Business Database	F	2	32	24	8	3th	Co-developed with SVL
Mainframe Programming Language (COBOL)	P	2	32	16	16	5th	
CICS and Transaction Development	P	2	32	16	16	6th	
Case study of Mainframe Banking System	I	3	48	16	24	6th	MOE-IBM Model Co-developed with SVL
Principle of z/OS system management	F	3	48	40	8	4th	
Practice of Mainframe System administration	P	2	32	20	12	5th	MOE-IBM Model
DB2 Query Optimization	F	3	48	30	18	6th	By SVL experts Co-developed with SVL
Mainframe Assembly Language	P	2	32	16	16	6th	By Bank expert Guest Professor
Project Management	F	2	32	24	8	6th	MOE-IBM Model

\* MOE-IBM: Ministry of Education of China(MOE) – IBM Model course, which is a qualification honored to selected outstanding courses in IBM technology, and is promoted by MOE to all Chinese Universities.

For the course categories, we have the following:

1) Fundamentals and principles (F)

Those courses mainly introduce the software and hardware concepts of all computers through lectures, with added slides to include mainframe as an important case in the computer family. Students shall command the basic knowledge of mainframe architecture, the operating system, and concepts of system administration, as well as database theories.

2) Practical technologies (P)

These courses are designed with the practical skills for the future application developers and system administrators, and requires a large amount of hands on experiments. Topics covered including application developing on mainframe, mainframe transaction server, assembly language, database administration and system administration.

3) Integrated courses (I)

To enhance the knowledge and skills obtained from the above courses, promote creativity and innovation of the students, as well as further develop the practical students through projects, we designed integrated courses, which introduce real world business cases and challenge for project solutions. The integrated course will prepare the students for their future work, through experiencing the whole project developing cycle and developing practical skills.

## 5. Conclusions

Since the starting of the program in 2005, we have been continuously exploring our own

way of mainframe education, and constantly digesting and absorbing the advanced experience of domestic and foreign counterparts. Over the past four years we have brought up 150 undergraduates with mainframe specialty, most of them got employed by IBM, State Street, First Data, ICBC, ABC and other big companies with international reputation, and engaged in mainframe related positions. Looking into the future, we'll continue to open up further, welcoming opportunities for cooperation with foreign enterprises and universities using the mainframe, especially those in the US. We're hoping to get your interest, and together probing possibilities for more collaboration.

END