



**Completion Report**  
**Project Supported by LTC/OBA Funding\***

8B0D

(Period covered: 1 Sep 2008 - 31 Aug 2010 )

**Part I: General Information**

Funding Source (please tick ✓ as appropriate):  LTC  OBA Funding

Project Code:

Host Department:

Project Title:

Project Leader (Name & Dept):

Team Member(s) (Name & Dept):

Project Team:

**Part II: Project Details**

**1. Financial Information**

**(a) Overview**

Approved Funding:

Additional Funding Received (if any):

Total Funding Received:

+  =

Source of Additional Funding:

**(b) Project Expenditure**

\* Please give reasons for the revised budget and quote the relevant authority's approval reference where appropriate.

**2. Project Schedule**

Dates as Stated in Original Proposal:

Completion date (dd/mm/yyyy):

Start date (dd/mm/yyyy):

Completion date (dd/mm/yyyy):

Actual Start and Completion Dates:

1 September 2008

31 August 2010

Project Period Extension(s) (if any):

Total no. of extension(s) obtained :

time(s)

Obtained during the project period:

For a total of

month(s)

Reason(s) for Extension(s) (if any):

\* LTC: Learning and Teaching Committee

OBA Funding: Funding for Promoting Outcome-Based Approaches to Student Learning

### 3. Project Implementation

#### (a) Project objectives

In this project, we aim to develop an objective assessment tool and a supplementary learning engine. It requires the development of a web-based system with a direct link with a market data stream. The proposed system intends to support our students in achieving some of the intended learning outcomes.

Through active participation in the project, students are required to make real investment decisions under a real environment, and subsequent feedbacks will be provided by the system. Students should integrate the knowledge in mathematics, statistics, finance and investment science to tackle planning and decision problems in investment and risk management. We expect students utilize both quantitative and analytical techniques in making investment decision and develop and apply mathematical and financial models effectively to solve their problems in the project works. After this project, we anticipate that students will be more aware of risks and will be able to develop better attitudes toward risk and uncertainty.

#### (b) Overview of specific work undertaken for achieving the project objectives (including any changes to original proposal)

In the following sections, we will first summarize the work that has been accomplished to build up a web-based system with a direct link with a market data stream, and then we will discuss the work to integrate the developed system into student learning.

#### 1. The web-based platform

In order to create a functioning web-based platform, the following issues have been addressed:

- Data Definition ([2], Ch. 4)
- System Specifications ([2], Ch. 5)
- System Functionality
  - System Main page ([1], Ch. 4.1)
  - Trading platform ([1], Ch. 4.2)
  - Market data stream ([1], Ch. 4.3)
- System integration and testing.
- Documentation

### Data Definition

We have included stock, bond, option, warrant, future, commodity and currency as the financial products provided in our platform. We have located the source and the methods to extract all the required financial data from the Bloomberg system. After considering the requirements, we have decided to connect Bloomberg system to download data regularly in batch mode (refer to Fig. 1).

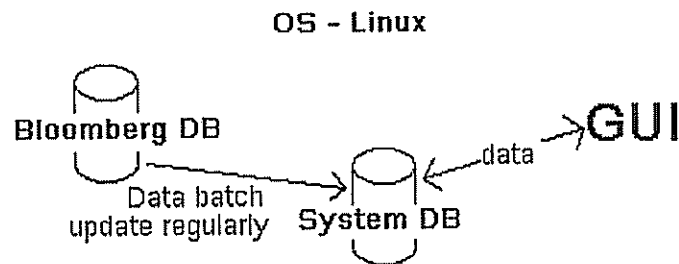


Fig. 1

An extensive data definition has been completed. We then created the following database schema ([2], Ch 5.3):

*Product information:* Store product information provided in the system

*Price List:* Store the updated price related information

*Order:* Store required information of order input from the web system

*Portfolio:* Store portfolio information with historical changes

*Benchmark Performance List:* provide storage for performance data of the fund benchmark

*Performance List:* provide storage for performance result of the accounts

*Group information:* provide storage for user account settings

*Risk Analysis List:* organized data storage for risk Analysis function of the system

*Market Data-stream information:* Storage of information for product data download

*Message information:* provide storage of message information

### System Specifications

We have set up a Linux server computer for system operations and provide storage of the database, web system and other software and add in components which support the running of the whole system. The system database is supported by MySQL. Since we have roughly to support the access of 10 accounts for the training purpose, and thus we have applied below configuration in our web server computer set up.

#### Hardware ([2], Ch. 5.1)

CPU: Intel P4 3.4G Hz

Random access memory (RAM): 1 x 512 Mega bytes

Hard Disk: 1 x 80 Giga bytes

Serial ATA (SATA): SATA Revision 1.0 (SATA 1.5Gb/s)

Network IP: 158.132.174.230

Network domain: http://amais.ma.polyu.edu.hk/

Network card speed: 100 MHz

Ethernet Speed: 1 GHz

### Software ([2], Ch. 5.2)

Operating system (OS): Fedora 11 kernel which built on top of the Linux 2.6.27

GUI Interface: X Window Gnome System

Web server support: Apache HTTP Server

Database Management System: C + MySQL

Web-page interface: PHP, javascript

Market Data Stream: C API interface

### System Functionality

The general functional specifications for the project have been identified. We have summarized major functions as follows:

#### A. System Main page ([2], Ch. 6)

*Login function.* Users are required to provide account name and password on the web main page; this provides security measure to prevent unauthorized access.

*Ticker quotation.* Financial product details, such as bid/ask price, transaction volume, volatility, are shown with proper ticker input in the web main page.

*Group performance reference.* It provides the details about the winning portfolio and overall group average result, such as portfolio whole period return, performance comparison with benchmarks, relative risk and top three holdings in the winning portfolio. In addition, we provide three largest positive and negative portfolio return changes in daily basis, and also we include the daily return of the suggested benchmarks as a reference.

*Quick reference guide on investment and risk analysis.* It includes an investment diary (reference guide) which provides some reference knowledge, such as portfolio and risk management, asset class characteristics and its descriptions, and some suggested procedures for using the Bloomberg system in investment analysis; the purpose of this diary encourages students in self learning, and provides a better start point for them to explore in investment management. In addition, we employ some common investment indicators applied by the industry and display the tickers accordingly to stimulate students' interest and provide a suggested way in investment decision.

## B. Trading Platform ([2], Ch. 7, 8)

*Account administration.* The platform provides some basic functions to create and delete groups; reset and change password and view group information details.

*Ticker search.* This function performs search of the financial product details in our database by ticker code, asset classes or volatility constraints.

*Make and View order.* The functions are performed through our web platform, while orders are matched in sequence after the market closed according to the order input time ([2], Ch. 8.1), and trading restrictions imposed; transaction results are updated in our database for users to access through the web platform, historical transactions can be viewed as well.

*Portfolio performance measures.* Users can access their portfolio status, such as asset allocation and capital growth, and performance results through the web interfaces. In our system, we provide portfolio return, benchmark and peer group performance comparison, so that it provide a reference for both students and lecturer to assess the portfolio performance.

*Message management function.* Lecturer can write, delete, and amend short messages through the web platform; students can access the messages when they login to the platform.

*Risk Analysis function.* Students should upload their analysis outcomes through this function; it stores students' inputs regarding their procedures, reasoning and outcomes of their risk analysis works. Users may review their historical analysis for reference, and it also provides lecturer a useful indicator to assess the students' works and performance.

## C. Market data stream ([2], Ch. 9)

We have finished the development of this function by integrating different build in functions in the operating system and programming tools. We have successfully applied a scheduler to call our tailor made computer program to access the market data stream automatically, and after several weeks of testing, the successful rate is 100%.

## D. System integration and testing.

In the first stage, we have tested the proper functioning of the hardware and software, and also the database system, like data retrieval and updating.

In the second stage, we have tested the online stock market trading system and the connection between web system and the database. For security reason, we have restricted the access of our system within the AMA domain, and we have ensured the security measure is properly run.

In the third stage, we have integrated the developed software system with the Bloomberg market databases. We have tested the system by simulating different cases to ensure the information displayed should be accurate and the system is stable and smooth in operations.

In the final stage, we have tested the proper functioning of help menu system, portfolio performance

measures and risk analysis system; we have debugged the system with test samples covered most of the scenarios. ([2], Ch. 8)

#### E. Documentation

We have listed all the technical details in the technical documentation, such as hardware specification, source codes for web system and market data stream access; while system instruction guidebook was completed to introduce the functionalities and operations of the system, and some examples to guide the users to use our system, and finally we provided a guidebook for conducting student case study , which include the details of applying our web system in an active participation activity and the overall results of this activity in student learning.

### **2. Integrating our system into student learning activities**

During the second semester of 2008/09, we applied the Bloomberg system in some case studies in investment decision for students as the project pilot run study. The objective of this pilot run is to find out the most effective way for students to achieve their competence in some of the major learning outcomes. We focus on students' analytic skills on the financial market and risk management. They are required to hand in a detailed report based on their decisions and analysis. After the pilot run, we found that our direction is correct. Students have gained the experience in applying what they learnt practically to solve some real life investment related problems, and concurrently major learning outcomes have been reinforced when they integrated knowledge in different disciplines. With this fundamental experience, we built up our web system with suitable modification to reinforce the positive effect in education, and we have applied the final system in the group case study of AMA 495 in 2009/10. ([3], Ch. 4)

(c) Difficulties encountered, if any, which have affected progress, and remedial actions taken

No major difficulty encountered during the period.

(d) Deliverables/useful findings/good practices emerged

Major deliverables of the project include a web-based system linking directly to market data for portfolio and risk management training, and a database system storing transaction history, analysis outcomes by students and performance benchmarking. The system will help our students on achieving some of the learning outcomes in a more effective way. In addition, we have prepared three guidebooks on education design and application, system user guide and technical documentation. Other deliverables are the following.

#### **Design of rubrics**

With the consultation and advices from Dr. Sun of EDC, we have designed rubrics to assess students

with the following requirements: ([3], Ch. 5.2 & Appendix B for details)

*The use of Technical Knowledge:*

Students should demonstrate and apply appropriate techniques in solving their problems (such as, mathematics/ statistics/ finance/ investment) with clear concepts and operations, and illustrate the techniques with in-depth supports and information

*Integration of ideas and information in practical problem:*

*Identify background problem in professional way*, students should provide review of relevant background information or previous work with appropriate explanations and evidence of ideas; while questions and goals are clearly defined with in-depth supports and reflects a sophisticated understanding of processes

*Collecting information in right manner*, student should show their ability to analyze search results and evaluate the appropriateness of the variety of relevant sources of information, and integrate information from a variety of sources, draw appropriate conclusions, and is able to clearly communicate ideas to others.

*Creative thinking:*

*Resourcefulness & synthesis*, student should show resourcefulness and creativity in use of data and quality resources, methodology and strategy to work out solutions. In addition, they should integrate the knowledge and information in an accurate and unified way.

*Originality and creativity shown in presentation*, student should generate many good ideas to solve the problem, and thinking “outside the box” to the problem.

*Written communication:*

*Content and Organization*, student should fulfill all the task requirements with acceptable performance; while arguments, opinions, and analyses should be supported based on a good range of viewpoints and/ or source materials.

*Layout, grammar, spelling, presentation*, student should present their findings in a professional way.

### **Project Evaluation**

We have collected opinions on the system from the students via questionnaires ([3], Ch. 6), and organized a sharing session with other colleagues. We have consulted the opinions of financial professionals. We have designed a set of questionnaires for students to assess the effectiveness of the project ([3], Appendix A).

A good practice of learning risk management is to make an effort to manage certain portfolios directly. In this way, students will have to explore mathematical tools and techniques for analysis

independently in order to substantiate their choices and performance. Also, students will be more aware of risks after working on the activities and will be able to develop better attitudes toward risk and uncertainty. In addition, since our system links closely with the Bloomberg system which is one of the major information providers in the financial industry, it will be a good opportunity for students to learn about the industrial standard during the course of this project. According to the student survey and evaluation on the student works, we conclude that most of the students have agreed that after using the system they have improved their knowledge in finance operation, like portfolio management, risk management, market operation, and asset class characteristics.

Our project has motivated students' creativity to do their analysis, which is one of the core student learning outcomes to be fulfilled in AMA 495. We found that students have explored outside our defined scope spontaneously and created some novel works in their case study. For example a student group has studied the impact of the recent Sichuan Earthquake as a new stress test scenario, which is not provided in Bloomberg system, but with great value to identify the portfolio risk exposure under catastrophe circumstances. Some other groups learnt to hedge the portfolio risk by using different derivative products (e.g. HSI Index future, Equity option/ warrant). Except the achievement in technical knowledge enhancement, our project has initiated students' interest in finance and risk management and motivated students to self-learning. Students showed interest to our project and are willing to explore more in finance and investment areas after the project work.

(e) Dissemination activities taken/planned to sustain impact

In the second semester of 2009/10, we applied the web-based platform for investment decision case study as the dissemination activity ([3], Ch. 5.3). This gives students an opportunity to demonstrate their competence in some of the major learning outcomes assessed through the rubrics ([3], Appendix B). Students are required to integrate their knowledge in mathematics, statistics, finance and investment science for managing a portfolio in a real-life controlled environment, and they should employ different quantitative models learnt from other courses. Students are expected to upload some of their analysis onto our web interface ([3], Ch. 5.5.3), and finally they are also required to hand in a detailed report based on their decisions and analysis.

During the case study, we arranged some training courses for using Bloomberg professionally, since the students need the Bloomberg system for analysis; by this way, they can gain practical experience in using the Bloomberg system for data collection, build-in tools for portfolio risk analysis and management. ([3], Ch. 5.3)

We have categorized the case study into defining investment objectives, designing the portfolio,



carrying out risk analysis and implementing performance analysis for illustration purpose. We have included the requirements, procedures, and some examples in the handout of the case study. ([3], Ch. 5.5).

In the assessment, we focused on their portfolio risk and return performance comparing with benchmark index and market peer groups ([3], Ch. 5.5.4); we have also defined a rubric for work requirements. Generally, student can fulfill the stated learning outcomes in working through the case study. They are able to include suitable information and demonstrate their technical skills and knowledge when explaining the models and procedures in a well presented logical flow and format. They can master the solution methodologies and integrate their knowledge in solving the investment related problems with in-depth analysis about the portfolio performance and portfolio risk.

After the case study, students are requested to fill in the questionnaire regarding efficiency of the web-based system and the design of the case study. The focus of this survey is in three main aspects, namely knowhow, motivation and system efficiency. ([3], Ch. 6)

In summary, most of the students agree that they can learn some concrete knowledge about finance and investment after using our system. Students are more familiar with the market operation, portfolio and risk management after using our web system. They appreciate that our system can initiate their interest in finance and risk management and motivate self-learning in the subject. The students think that our system is user-friendly in general, easy to use, and the information provided is good enough for their analysis and financial decision making.

(f) Self-evaluation or additional information/remarks

In order to further improve our system to be even more real-time and functional in market operation and performance evaluation, we suggest the following possible future works as the extension of this project.

(i) Automatic Historical Performance Analysis by FTP

Due to the new service from Bloomberg launched recently, we may now transfer the portfolio records in excel format to Bloomberg destined FTP server, so that Bloomberg can automatically upload the portfolio records in their system for analysis. We can access their VaR, stress test and historical performance analysis function by the excel report generated from Bloomberg. We may tailor made some programs to capture the information in those reports and upload it to our database system. In the historical performance analysis, we can evaluate the user portfolio in much greater extent, since it provides Jensen alpha analysis, Sharpe Ratio, portfolio beta, portfolio standard deviation.

(ii) Order Match with Intra-day Data

We may improve of the order matching system by using the Intra-day data downloaded from the Bloomberg system, so that the transaction rate will be more realistic to reflect the market demand and supply when the order is placed. It is a better approach compared with our current method by using the daily closing price, since the price movement becomes larger within a day.

(iii) Companies' Corporate Events Automatic Settlement

We may extent the functionality of our current system by including the settlement processes for corporate events on financial products which still do not consider in our system. Below is the list for common settlement process we should consider to be included.

1. Cash dividend for Equity and related products
2. Stock dividend for Equity and related products
3. Stock merges/ split for Equity and related products
4. Delisting for Equity and related products
5. Right Issue for Equity and related products

(iv) Automatic Settlement for Option Call

Since the market has American type option available for trade, but due to our system limitation, user can only sell the option in the market for cash. Thus, we can improve our system to be more realistic by allowing the user to call the option under the product's terms and conditions.

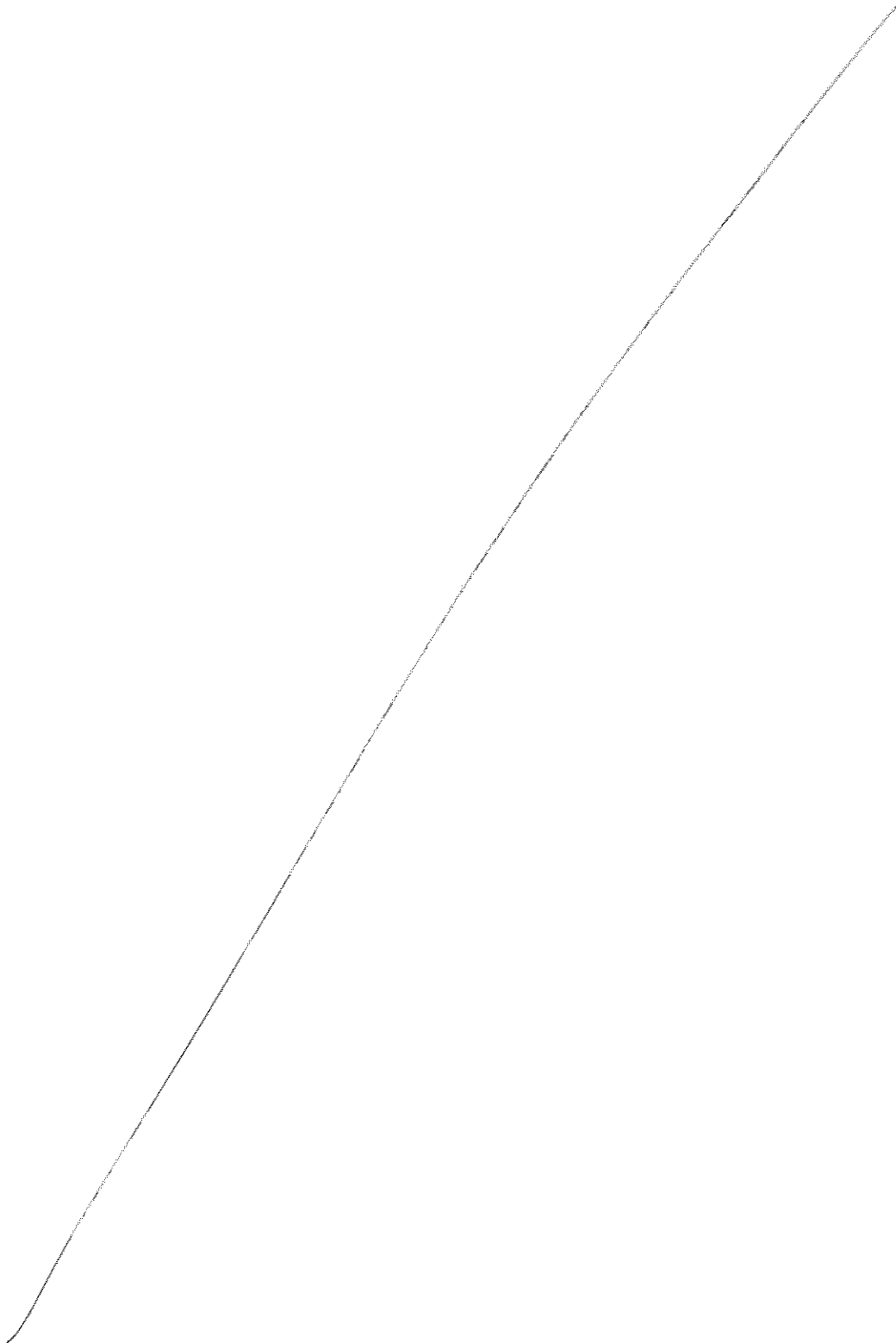
(v) Hardware Upgrade

We can greatly improve the web response time by upgrading the server with faster CPU, RAM. Since some students suggested that our server is quite slow in response.

**Reference:**

- [1] System Guidebook of the web-based system. Department of Applied Mathematics, The Hong Kong Polytechnic University. 2010
- [2] Technical Documentation of the web-based system. Department of Applied Mathematics, The Hong Kong Polytechnic University. 2010
- [3] Guidebook for Conducting Student Case Study by the web-based system. Department of Applied Mathematics, The Hong Kong Polytechnic University. 2010

Name of Project Leader: Yiu Ka Fai Cedric Date: 3 Sept. 2010  
(in block letters)



**Part III: Evaluation by D/SLTC (or by HoD/Director of School)**

(a) Rating and comments/recommendations on the following areas of the project

(please put a ✓ in 1 of the following 2 ratings and provide comments)

Areas	Rating		Comments and Recommendations
	Satisfactory	Needing attention	
Overall financial management/ use of funding	✓		
Overall project progress	✓		
Outputs /deliverables / dissemination	✓		
Overall rating / comments on the project (Please suggest remedial actions if the rating is 'Needing attention')	✓		

(b) Issues requiring the attention of FLTC/Director of School and/or the funding authority

(c) Outputs/deliverables/good practices of the project that can be shared with other subjects, programmes or departments within the Faculty, or with the wider PolyU community

(d) Additional comments/remarks

Name of D/SLTC Chair  
(or HoD/Director of School):

YANPING LIN  
(in block letters)

Date:

NOV 30 2010

^ To be prepared by HoD/Director of School if the PL is also the D/SLTC Chair, or if the Centre/Unit/Office does not have a DLTC.

**Part IV: Evaluation by FLTC/Director of School#**

(a) Overall rating on the project (please put a ✓ in 1 of the following 2 ratings):

- Satisfactory
- Needing attention

(b) Overall comments and recommendations on the project:

*make this available to current and future students so as to improve their T/L.*

(c) Issues requiring the attention of the funding authority:

Name of FLTC Chair/  
Director of School:

CK CHAN  
(in block letters)

Date:

22/12/10

# The Director of School or HoD of the Centre/Unit/Office needs not fill this part if he/she has already commented in Part III.

**Part V: Response & Follow-up Plan by Project Leader**

(Response and follow-up plan is required from the Project Leader if there is any area rated as 'needing attention' in Part III and/or IV.)

Empty box for response and follow-up plan.

Name of Project Leader:

(in block letters)

Date:

*[Signature]*

Signature of Project Leader

*[Signature]*

Signature of D/SLTC (or HoD)@

*[Signature]*

Signature of FLTC/  
Director of School

YIU KA FAI

(Name in block letters)

YANNING LIN

(Name in block letters)

CK Chan

(Name in block letters)

@ To be signed by HoD if the PL is also the DLTC Chair, or if the Centre/Unit/Office does not have a DLTC; leave this blank if the PL is also the SLTC Chair.

The Project Leader and D/SLTC Secretary should each keep a copy of this *Completion Report* for records. A copy of this *Completion Report* will be submitted along with the *F/SLTC Annual Report (Form 20)* to LTC/WGOBE as a supporting document.

