

Services Sciences at Manchester: Bringing People, Business and Technology Together

Liping Zhao

University of Manchester
School of Informatics, Manchester, U.K.
liping.zhao@manchester.ac.uk

Linda Macaulay

University of Manchester
School of Informatics, Manchester, U.K.
linda.macaulay@manchester.ac.uk

Paul Verschueren

IBM Software Group
paulv@uk.ibm.com

Jonathan Adams

IBM Software Group
jonathan_adams@uk.ibm.com

ABSTRACT

IBM's Services, Sciences, Management, and Engineering (SSME) agenda proposes an emerging, multidisciplinary field that integrates a variety of technical and business fields under a general concept of "services". One important idea of the SSME agenda is innovative design in the 21st century. This paper presents our SSME related activities around innovative business and curriculum design. Our business design focuses on IBM's Patterns for e-business whereas our curriculum design aims at providing students with new skills. These two activities are cross-fertilized owing to our collaborations with IBM through IBM Faculty Awards and the Strategic Partner Programme.

INTRODUCTION

IBM's Services, Sciences, Management, and Engineering (SSME) agenda [5] proposes an emerging, multidisciplinary field that integrates a variety of technical and business fields under a general concept of "services". One important idea of the SSME agenda is innovative design in the 21st century. In his lecture at the University of Manchester, Wladawsky-Berger [6] put forward two cases of innovative design: business design and university curriculum design. The purpose of designing business is to identify its structure and components so that it can be integrated into a successful (and possibly global) enterprise; the purpose of designing university curriculum is to help students understand techniques for use in enabling such a business. Although the SSME framework is yet to be defined and developed, we believe that it builds on two foundations—systems theory and design theory—and three corner stones—people, business and technology.

This paper presents our SSME related activities around innovative business and curriculum design. Our business design is a research activity based on IBM's Patterns for e-business whereas our curriculum design focuses on providing students with new skills. These two activities are cross-fertilized owing to our collaborations with IBM.

Before presenting these activities, this paper first describes our environment within which these activities have been cultivated.

CONTEXT

Informatics at Manchester

In September 2004, two leading universities in the United Kingdom, Victoria University of Manchester (VUM) and University of Manchester Institute of Science and Technology (UMIST), joined together to form the new University of Manchester (UoM). As a result of this merge, a new "i-School", the School of Informatics (<http://www.informatics.manchester.ac.uk/>) was created from the old Department of Computation at UMIST, to pursue a new vision of computer science as the science of information, systems and design. Located in the Faculty of Humanities, Informatics draws upon a range of disciplines, including computer science, design, psychology, business and management, to conduct multi-disciplinary study and design of computer systems for people, business and information technology. Informatics' education aim is to equip the students with the new skills required for the 21st century, including technical, people and multidisciplinary design skills.

Clearly, Informatics' vision is closely related to the SSME agenda.

IBM Faculty Awards

In 2004, Jonathan Adams, Distinguished Engineer at IBM, sponsored an IBM Global Faculty Award to the then two different universities, UMIST and VUM. The award was given to four academics, with Professor Linda Macaulay (Computation, UMIST) and Professor Brian Warboys (Computer Science, VUM) as Principal Investigators and Dr Peter Kawalek (Manchester Business School, UMIST) and Dr Liping Zhao (Computation, UMIST) as Co-investigators.

The original aim of the award was to bring together researchers of different schools and disciplines to explore IBM Patterns for e-business [1] from three dimensions: research, teaching and business. The actual effect of this award, however, was far more significant. First, the award brought together researchers from two universities during a time of change and in this respect the award facilitated an understanding of and respect for differing perspectives. Second, the award stimulated the development of a new MSc programme at Informatics—MSc e-business Technology—which would bring IBM’s Patterns to the attention of a new generation of graduate students. Finally, the award led to a deeper interest in patterns. Such an interest would later become a common core for our pattern-oriented SSME research under the UoM-IBM Strategic Partner Programme.

Following the success of the first IBM Faculty Award, Adams sponsored Macaulay and Zhao with a second award in 2005, to encourage them to explore the role of Patterns for e-business in supporting the emerging Services Sciences discipline through research and teaching (<http://www.research.ibm.com/ssme/workuniv.shtml>). This award has further strengthened the relationship between Informatics and IBM and helped to develop a new collaboration with Paul Verschuere, Senior Consulting Architect at IBM and Chair of IBM Patterns Governance Board. More importantly, the award has connected the four authors of this paper through a shared interest in patterns, to explore the role of patterns in SSME for business design and to teach the students this design approach.

Partners (UoM/IBM)	Programme
Linda Macaulay/ Jonathan Adams	Extend IBM Patterns in the area of Facilitated Collaboration and explore the SSME agenda
Liping Zhao / Paul Verschuere	Explore the role of patterns in the SSME agenda and develop techniques to support patterns
Bob Wood / Henry Law	Explore the role of the IT Architect and its future impact on teaching and research
Kung-Kiu Lau / Trevor Hopkins	Construct large software applications using components
Barbara Jones / Angelo Failla	Focus on developing new ICT skills in organizations that are undergoing rapid change and how employees apply that knowledge as new challenges arise
Alex May / Andy Heys	Develop bio-health informatics

Table 1. The UoM-IBM Strategic Partner Programme.

UoM-IBM Strategic Partner Programme

The UoM-IBM Strategic Partner Programme was launched in January 2006 to explore areas of overlapping strategic importance to both organizations across research, teaching and recruitment. We are four of the 12 partners appointed in the first year. It is also worth mentioning that of the six partners from UoM, three partners are from Informatics: Professor Linda Macaulay, Professor Bob Wood and Dr Liping Zhao. Table 1 summarizes the UoM-IBM partner programme. Clearly, this programme accords with the SSME agenda.

UK Network of Researchers in Services Sciences

In order to bring together researchers from a range of disciplines across the UK to develop a shared understanding and research agenda of SSME, Macaulay and Zhao are driving a proposal for the development of a UK Network of Researchers in Services Sciences. Currently, 14 leading academics from different UK universities have joined us to serve as the founding members of the proposed network; two leading companies, IBM and HP, have agreed to sponsor this network.

BUSINESS DESIGN USING PATTERNS

IBM is a leading business designer who has developed a large number of methods and technologies that support business design. Among these technologies are Component Business Modeling (CBM), Service Oriented Modeling and Architecture (SOMA), and Patterns for e-business (P4eb). CBM and SOMA are used to identify and describe the business processes whereas P4eb map these processes onto the architectural components of the software systems.

P4eb was identified from thousands of successful IBM application development projects by Adams and his colleagues at IBM [1]. These patterns give businesses a set of proven, reusable architectural components that can guide the design, development, implementation and extension of e-business applications.

P4eb are organized into a hierarchy. At the top level are four Business Patterns: Self-Service, Collaboration, Information Aggregation and Extended Enterprise. These four patterns represent four distinctive types of business interaction. Specifically, Self-Service describes the interaction between users and businesses; Collaboration captures the interaction between users; Information Aggregation represents the interaction between users and data; Extended Enterprise expresses the interaction between businesses. Each Business Pattern is specialized into a set of Application Patterns, which, in turn, are further divided into Runtime Patterns. An Application Pattern describes a logical design of the system whereas a Runtime Pattern suggests an implementation plan (product mapping) for the system. Business Patterns are supported by other patterns such as Integration Patterns, which are Access Integration, for the front-end system integration, and Application Integration, for the back-end system integration.

We are conducting research to enhance P4eb in the following areas.

- Extend the Collaboration pattern family with new patterns, such as facilitated collaboration patterns.
- Extend P4eb with business logic patterns. P4eb are the solutions to the architectural design of the business systems, but not the solutions for the business logic design of the applications. Although the business logic solutions can be provided by other approaches, such as CBM and SOMA, we are exploring a pattern-oriented approach to designing business logic and components.
- Develop methods and tools for pattern organization and selection. Although the top level of P4eb only has four Business Patterns, the number of patterns grows exponentially at the lower-levels. For example, there are about 100 Application Patterns and hundreds of Runtime Patterns. Methods and tools that support effective pattern organization and selection are therefore urgently needed.

We propose to use patterns to support business design in relation to SSME agenda for the following related reasons.

- Patterns are a universal design concept. Either in art or engineering, patterns represent geometric arrangements of parts that can be used over again. For example, patterns are used to design dresses, carpets, wallpapers, airplanes, buildings [2], and software [4], to name only a few. As a design concept, patterns preserve tried, tested experience and best practice. Patterns mean goodness and fit.
- Patterns are a recurring phenomenon. Thus we can speak of weather patterns, symptoms, DNA sequences, communication and control patterns, and behavioral patterns.
- Patterns are relationships between parts and wholes in natural as well as artificial systems [3]. Thus patterns capture fundamental organizing principles and structures in systems, such as the structures of molecules, society, and computer systems.

In addition, patterns give us an effective, common language for communication, so that we can say: “Let’s use Self-Service for this business application”, or “This is an Extended Enterprise problem.” Patterns, as in the form of IBM P4eb, are organized as a hierarchy. By using such a hierarchy of patterns, we can decompose a problem space. For example, the Self-Service pattern can be decomposed into different Application Patterns which are then divided into different Runtime Patterns and so on. In this respect, patterns help us to reduce the design complexity.

SSME COURSE DESIGN

According to Wladawsky-Berger [6], UoM is among 11 selected universities who have developed SSME courses. In particular, Informatics at UoM has introduced the following four new Master of Science (MSc) programmes.

- MSc e-business Technology
- MSc Business Information Technology
- MSc Text Mining
- MEnt Informatics

Combining the School’s strengths in Information Systems, Data and Knowledge Engineering, and Interactive Systems Design, the thrust of these new Master programmes is human-centric business design and computing. The programmes provide the students who have a computing related undergraduate degree with new and transferable skills required in the services sector. To help the students to choose a suitable programme, possible career paths are given for each programme. The programmes were in operation in September 2005, with the first students graduating in September 2006.

Currently, all the programmes except MEnt have 7 taught courses and one Dissertation Project whereas MEnt has 3 taught courses and one real world Enterprise Project.

In the following sections, we briefly describe these four programmes and their links to the SSME agenda. In addition to these four programmes, a new MSc programme on e-services design has been planned for 2007, to be offered jointly by Informatics and IBM.

MSc e-business Technology

Today nearly every business involves some technology support. The Internet has become the gateway to most businesses. E-business is therefore a norm for business. This MSc programme equips the students with the skills in analysis, design and development of e-business application systems. Possible career paths for the students upon successful completion of the programme include e-business analysis and design, solutions development, and web service development and web site design.

Among other taught courses offered in this programme are *e-business* and *Patterns for e-business Applications*, which directly address the SSME agenda. The e-business course teaches the students the following components: (1) e-business infrastructure and strategy; (2) supply chain management and e-procurement; (3) customer relationship management; (4) e-marketing; (5) collaborative commerce; (6) case studies. The Patterns for e-business Applications course teaches the students the following components: (1) relationships between business requirements and e-business application architectures; (2) relationships between business drivers and technologies; (3) IBM’s Patterns for e-business as solutions for e-business application system design; (4) relationships between business processes and IBM Patterns; (5) real world case studies.

These two courses are developed as a result of the two IBM Faculty Awards described above and team-taught by the four authors: Macaulay is the academic instructor for the e-business course with Adams as the industrial instructor;

Zhao is the academic instructor for Patterns for e-business course with Verschueren as the industrial instructor. The courses have attracted 80 students from the UK and abroad, and proved to be very successful and popular among the students. Students' performance and feedback have indicated that patterns provide an effective pedagogical tool to e-business application design and help the students to gain a better understanding of the relationship between business needs and technical solutions.

MSc Business Information Technology

This programme teaches the students the skills in business modeling and information management. The students will be equipped to follow career paths in IT management including procurement, auditing, and marketing, as well as technical roles in database management, user and application support, and business analysis.

In relation to the SSME agenda, this programme offers two strong courses:

- **Enterprise Systems Modeling.** Business operations have become increasingly complex. Understanding the behavior and operations of the business is a precursor to the development of business application systems. Business modeling aims to offer such an understanding and teaches the students modeling complex business systems from three perspectives: strategic decision modeling, business process modeling and business requirements modeling.
- **Information Management.** Information has become a major asset and resource in modern organizations. Effective information management is essential to any business. This course teaches the students the techniques of information management from the following aspects: (1) how to manage an organizational information resource strategically and operationally; (2) how to exploit and deploy information effectively within and across organizations.

Unlike traditional information technology courses, this MSc programme helps the students to understand how information and software systems can be best exploited within the organizational environment to manage data, information and knowledge, rather than how these systems are built.

MSc Text Mining

Text mining is a vital growth area that deals with the information overload problem. As the information published on the web and in print grows exponentially, scientists and organizations need information extraction tools to find the relevant data from the unstructured information haystack. Text mining is an exciting area to

support scientists and organizations to conduct their scientific investigation or business activities.

This programme helps the students to develop skills in natural language processing, data mining and information retrieval approaches; it equips the students with a variety of career paths in bioinformatics or other organizations, as service engineers to help the organizations discover useful information and knowledge. The programme is taught by UK's National Text Mining Centre at Informatics and supported under an IBM Innovation Award.

MEnt Informatics

This is a distinctive and innovative programme, targeting both newly-graduated and established scientists and engineers who wish to move into a small or a start-up technology-based company and helping them to develop their own technology-based business concept.

The main objective of the programme, which aligns closely with the SSME agenda, is to provide the students with knowledge and skills in the fields of technology, science and business, enabling them to contribute fully to the development of the knowledge-based economy.

CONCLUSION

This paper has reported our SSME related research and teaching activities. Our research activity focuses on using patterns for business design whereas our teaching activity concentrates on designing new services courses for MSc students. The paper has also outlined our collaborations with IBM. If there is a key message this paper wishes to deliver, it is that SSME should take a systems approach to designing services systems for people, business and technology; and patterns are an important concept to be applied in systems design.

REFERENCES

1. J. Adams, S. Koushik, G. Vasudeva, and G. Galambos, *Patterns for e-business: A Strategy for Reuse*, IBM Press, 2001. Pattern descriptions also available at www.ibm.com/developerWorks/patterns
2. C. Alexander, *The Timeless Way of Building*, New York: Oxford University Press, 1979.
3. F. Capra, *The Web of Life*, Flamingo, 1997.
4. E. Gamma, R. Helm, R. Johnson, and J. Vlissides, *Design Patterns*. Addison-Wesley, Reading, MA, 1996.
5. P. Horn, "The New Discipline of Services Science," *Viewpoint, BusinessWeek online*, January 21st 2005.
6. I. Wladawsky-Berger, "Innovation in the 21 Century," *The Irving Wladawsky-Berger Lecture at the University of Manchester*, 21 March, 2006. Available at www.cs.manchester.ac.uk