INTRODUCTION

The global economy and organizations are evolving to become service-oriented. There have recently been more and more research works on services provision. Therefore, although Services Oriented Computing (SOC) were originated mainly from a computer science perspective (Zhang, 2004), the industry and academia have been shifting the focus to a cross-disciplinary approach. On one hand, from the perspective on SOC, the engineering of services aims to compose high-quality interoperable and collaborative systems, which is essential to fulfill general business requirements. On the other hand, our perspective of service-oriented engineering is the realization of successful systems that fulfils the goal of service excellence.

Some emphasis on system quality include: communications, control, integration among systems, human, organizations, and virtual communities, requirement elicitation and analysis, design science, reliability and quality engineering, exception handling, uncertainty, and risk management. Topics to facilitate the understanding of complex systems include infrastructure systems and services, self-organizing systems, mobile, ubiquitous, and pervasive systems, and system of systems. Although individual topics may have already been well-studied on its own, the design and development of complex systems often requires advanced combination of knowledge from multiple disciplines, which has not been adequately studied before. Further challenges arise from emerging and ever-evolving computing environment, under which completely new problem-solving strategies and tactics need to be developed.

Therefore, the emphasis of Systems Engineering (Kasser, 2007) on the interdisciplinary, holistic approaches and means to deal with complex and intelligent systems is in line with our perspective of service-oriented engineering. In fact, the perspective of systems engineering and service-oriented engineering can be roughly compared with top-down and bottom-up approaches: they often offer complimentary perspectives and solutions to complex problems and requirements. Thus, Systems and Service-Oriented Engineering (SSOE) forms an integrate focus of this book.

The Internet has become a common platform where organizations and individuals communicate amongst each other to carry out various business activities and well as communication (Chiu et al., 2003). With a top-down approach, the first section of the book is devoted to discuss some recent innovations of Web systems, such as those for improving system efficiency, semantic intelligent systems, and novel development methodologies. Next in section two, we explore more in-depth issues and innovations related to Web services such as improving system efficiency, semantic intelligent systems, and novel development methodologies, which is in line with our advocated SSOE approach. Finally in section three, we demonstrate how our SSOE approach works well with recent mobile innovations such
as mobile user behavior, mobile services, and Radio Frequency Identification (RFID), which make good use of the advancement of mobile devices with ever increasing range of communication, computing, storage capabilities.

In this preface, I would like to highlight some challenges and opportunities for SSOE and I introduce the contents of this book, which are also classified into these three sections. Then I introduce some of our recent professional activities in promoting SSOE before concluding this preface.

WEB SYSTEMS INNOVATIONS

With more and more users carrying out various business activities and communications over the Internet (Chiu et al., 2003), efficiency over the Internet has been a classical problem along with the complete Internet timeline. In particular, as the objective of all systems has the fundamental mission of serving humans, human collaboration requirements should never be ignored along with those for systems and their components. We refer to such integrated systems and human collaboration as e-collaboration. As e-collaboration has recently become a focus of systems engineering and design, efficiency studies is not restricted to the application or backend tiers for applications like business intelligence, but also to the frontend tiers for user interactions.

On the other hand, current Web technologies are ever evolving, towards Web 2.0, Web 3.0 (Lassila & Hendler, 2007), etc., so called Web x.0. Web 2.0 refers to a second generation of the Web, facilitating communication, information sharing, interoperability, and collaboration based on user-centered design. Virtual systems and virtual communities based on autonomous and peer-to-peer systems are therefore among the hottest research topics in line with our approach, relating systems and services.

Recently, despite much debate on the scope of Web 3.0, widely accepted key components of Web 3.0 include semantics and intelligence. Ontology is a formal semantic representation of concepts from a particular domain, as well as their relationships. Ontologies are frequently used for resolving terminological incompatibilities. Ontologies provides users and systems semantics for better understanding of their requirements, as well as related trust, reputation, security, forensic, and privacy issues for a better foundation of intelligent system behaviors. Example application areas include but not limit to service management, service marketing, relationship management, negotiations, auctions, and electronic marketplaces (Chiu, Poon, et al., 2005).

On the other hand, agent based technologies are some of the most promising solutions for the integration of systems, services, and people in an intelligent context (He et al., 2003; Chiu, Cheung, et al., 2010). Intelligent agents are considered as autonomous entities with abilities to execute tasks independently. Various technologies from artificial intelligence can be applied at services, agents, and systems level, including computational intelligence, soft computing, game theory, genetic algorithms, evolutionary computing, logics, machine learning, cybernetics, planning, optimization, and so on. Such intelligence can be further enhanced when application semantics are available from ontologies, and is vital for effective service matchmaking, recommendation, personalization, operation, and monitoring (Chiu, Yueh, et al., 2009), which are the basis of quality services.

Furthermore, the recent turbulence of the globalized economy together with fast-evolving information and communication technologies (ICT) has caused great impact on how businesses are being carried out currently and in the future. Such ever-growing complexity and requirement evolution demand a critical re-thinking on the methodologies based on SSOE, which also demands for much flexibility and intelligence.
Chapter Introductions

To illustrate some theoretical and analytical advancement in this perspective, the first section of this book contains eight chapters and centers on Web systems innovation. The articles can be roughly divided into three categories: improving system efficiency, semantic intelligent systems, and novel development methodologies.

For improving efficiency of Web systems, Ying & Miller (2011) design and implement a refactoring system called ART (ActionScript Refactoring Tool) to provide automatic support for Flash programmers by rewriting their ActionScript code to speed up their applications. This contributes a lot to rich Internet applications of Web 2.0 because many of them are written in Flash, but Flash programmers often have to focus on other functional design aspects and ignore performance due to tight production schedules.

Ying & Miller (2011a) further present a refactoring system called Form Transformation Tool (FTT) to assist Web programmers to refactor traditional forms into Ajax-enabled forms, while ensuring that functionality before and after refactoring is preserved. Ajax is a set of Web development technologies that enables web applications to behave more like desktop applications. Thus, this approach allows a richer, more interactive, and more efficient model for interactions between users and Web applications.

Yan, Yan, & Ma (2011) propose a contextual preference query method of eXtended Markup Language (XML) structural relaxation and content scoring for providing users with most relevant and ranked query results in XML queries. This contributes to resolving the problem of empty or too many answers returned from XML queries, which are widely used in the processing of Web 2.0 contents.

For semantic intelligent approaches, Maleewong, Anutariya, & Wuwongse (2011) introduce their Web-based collaborative knowledge management system, ciSAM, which applies widely-used IBIS and Toulmin’s argumentation schemes, to structurally capture the deliberation and collaboration occurred during the consensual knowledge creation process. As it employs standard Resource Description Framework (RDF) and Web Ontology Language (OWL) as its underlying knowledge representation language, users can easily create knowledge using a simple corresponding graphical notation with machine-processable semantics.

Yoosooka & Wuwongse (2011) propose a new approach to automatic retrieval and composition of Learning Objects (LOs) in an Adaptive Educational Hypermedia System (AEHS) using multidimensional learner characteristics to enhance learning effectiveness. The approach focuses on adaptive techniques and adaptation of rules to become generic in four components of AEHS: Learning Paths, LO Retrieval, LO Sequencing, and Examination Difficulty Levels. Hence, the application to various domains is possible. This approach dynamically selects, sequences, and composes LOs into an individual learning package to support extensive sharing based on the use of domain ontology, learner profiles, and LO metadata.

Gong, Overbeek, & Janseen (2011) propose the integration of Semantic Web and software agents with a methodology for exchanging rules between the Rule Interchange Format (RIF) of the World Wide Web Consortium and AgentSpeak of the Belief-Desire-Intension (BDI) agent architecture. This contributes to the translation between the two mainstream intelligent technologies for the Web.

For novel development methodologies, Chen, Ding, et al. (2011) propose a concept of background net to capture contextual association of words appeared in the articles recommended by the user through incremental learning. Fuzzy set associations to such words in a background net can therefore personalize keywords that represent different user knowledge background and preferences. This contributes to achieve better performance with integration to existing search engines. The implementation extended to their Knowware System, a knowledge base system development platform, enables further customized deployment and promotes reuse with this approach.
To conclude this section, Hermida, Meliá, & Montoyo (2011) present a model-driven design methodology called Semantic Models for Rich Internet Applications (RIA) that facilitates the development of semantic RIAs for the design of social network sites. This approach combines the main advantages of the current trends on the Web such as change in user behaviour and technology advancement. The application of a model-driven methodology can also speed up the development process and simplify the reuse of external sources of knowledge.

WEB SERVICE INNOVATIONS

As Zhang (2004) has pointed out, killer applications are required to drive Web Services researches. Since the publication of International Journal of Web Services Research (Zhang, 2004), basic researches for services have been steadily progressing. However, the big challenge of the design and development of killer applications from systems perspective is still emerging based on the accumulating experiences of services deployment within and across organizations.

Beyond SOC, intelligence in computing and knowledge from various disciplines (such as marketing, economics, management science, operations research, and psychology) is required to achieve service excellence for the ever complicating requirements in the rapidly evolving global environment. With further increasing popularity of mobile and ubiquitous computing, location and pervasive intelligence for services (Hong, Chiu et al., 2007; Chiu, Yueh, et al., 2009) is also an active research area with a wide horizon of possible advancement.

On the other hand, to scale up service provision, the Grid is a high-potential technology for the solution (Foster and Kesselman, 2004). Based on the Grid, concepts like software as a service (SaaS), Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Communications as a Service (CaaS), utility computing, meta-services, and recently Cloud Computing have emerged (Hayes, 2008). Cloud computing emphasizes on the realization of computing as a large collection of services rather than a single product, whereby shared resources, software, and information are provided to organizations and individual users anywhere anytime. Thus, many mature technologies are used as components in Cloud Computing, but still there are many unresolved and open problems. In particular, how traditional information systems can be (re-)engineered and migrated to new cloud platforms is a key issue of its adoption, especially intelligent ones.

Chapter Introductions

To illustrate some theoretical and analytical advancement in this perspective, the second section of this book centers on Web service innovations and contains seven chapters, which can be roughly divided into three categories: intelligent service support, service management, and service security.

For intelligent service support, Wang, Koehler, et al. (2011) propose a new hybrid provenance representation of annotation and inversion methods to achieve adaptiveness in storage constraint and response time requirement of provenance inversion on-the-fly. Data provenance refers to the description of the origins of a piece of data and the transformations by which it arrived in a database. This provides a foundation support for many types of intelligence services and systems.

Minguez, Silcher, et al. (2011) present a service bus architecture for flexible and adaptive application integration in the planning and production phases of a product lifecycle in event-driven manufactur-
ing environments. Their solution integrates an application-independent canonical message format for manufacturing events, content-based routing, transformation services, and event processing workflows.

Chen & Nepal (2011) design a service-oriented user interface for the next generation Web that leverages the advances of semantic Web and service composition technologies. This approach provides an intelligent and generic user interface to query, compose, and execute Web services for a variety of user tasks.

For service management, Badrabadi, Tarokh, & Mohammadi (2011) propose a game theory approach based on ex-ante contracted profit sharing principles to manage top-down changes initiated by the management of service-oriented enterprises that affects the cooperation of the services in a dynamic environment. Their approach help design explicit mechanisms that encourage services to innovations and take into account the biased interdependencies inside service-oriented enterprises.

Nepal & Chen (2011) design a framework for electronic contract services by introducing a Web Service Collaborative Context Definition Language (WS-CCDL) for dynamic business collaboration in emerging application domains such as e-Health, e-Science, e-Research, and e-Government. They also demonstrate its use with a universal (anywhere) connectivity service for a tele-Collaboration application in the context of e-Research domain. This approach supports effective creation and management of such collaborations through a standardized way of specifying requirements and the creation, negotiation, and execution of electronic contracts.

For service security, Jiague, Frappier, et al. (2011) present an automatic approach to transform security rules with patterns written in a state-chart like graphical notation, called ASTD, for enforcing the access-control policies with the Web Service Business Process Execution Language (BPEL). This enables the deployment of functional security rules to satisfy strict regulations imposed by governments, particularly in the financial and health sectors.

To conclude this section, Chiu, Hung, et al. (2011) propose protected exchange of documents through a Document / Image Exchange Platform (DIEP) based on contemporary technologies of Web services and watermarking, replacing traditional ad-hoc and manual exchange practices. To facilitate governance and regulation compliance against protection policy violation attempts, the platform can also notify the affected parties with alerts for warning and possible handling the management. This approach facilitates the whole governance process from technical to management level within a single unified platform.

MOBILE INNOVATIONS

Recent advances in information and communications technologies (ICT) have created a plethora of mobile devices with ever increasing range of communication, computing, and storage capabilities (Lin & Chlamtac, 2000). New mobile applications running on such devices provide users with easy access to remote services regardless of differing locations (Hong et al., 2007). Interesting mobile applications taking advantage of the ubiquity of wireless networking emerge to create new virtual worlds through expanded e-collaboration services (Chiu, Cheung et al., 2010). An example application is the management of mobile workforce in this knowledge and service based economy (Chiu et al., 2006), which is applicable to a wide range of domains such as supply-chain logistics (Wang et al., 2009), dynamic human resources planning, negotiation support (Chiu, Cheung et al., 2005), and tourism (Chiu, Yueh, et al., 2009). At any time and regardless of location, the management as well as professional workforces needs to collaborate with colleagues and communicates with information systems, not only within their own organization but also among other broader systems not directly synchronized with their own.
Mobile devices nowadays are generally equipped with adequate processing power to support reasonably complex computations (Chiu, Cheung et al., 2003). Sophisticated intelligence for collaboration and decision support, usually in the form of agents, is now possible on these platforms. This functionality is able to relieve people from repetitive tasks like their personal assistants (He et al., 2003; Chiu, Cheung et al., 2006).

Further, the widespread of mobile technologies has further resulted in an increasing demand for the support of mobile services across multiple platforms anytime and anywhere (Chiu, Cheung, et al., 2004). Examples include supply-chain logistics, group calendars, and dynamic human resources planning. As mobile devices become more powerful, the adoption of mobile computing is imminent. However, the realization of mobile services is not merely porting the software with an alternative user interface, but rather involves a wide range of new requirements, constraints, and technical challenges.

The recent advancement of workflow technologies and adoption of the SOC has much facilitated the automation of business collaboration within and across organizations to increase their competitiveness and responsiveness to the fast evolving global economic environment. The spread of mobile technologies has further resulted in an increasing demand for the support of Mobile Business Collaboration (MBC) across multiple platforms anytime and anywhere (Chiu et al., 2010). Examples include supply-chain logistics, group calendars, emergency handling (Chiu, Kwok, et al., 2009), mobile workforce management, and tourist support (Chiu, Yueh, et al. 2009). As mobile devices become more powerful, the adoption of mobile computing is imminent. However, mobile business collaboration is not merely porting the software with an alternative user interface (Chiu, Cheung, et al., 2003), but rather involves a wide range of new requirements, constraints, and technical challenges (Hong, Chiu, et al. 2007).

In addition, RFID (Rosenberg & Garfinkel, 2005) is a non-contact technology that uses radio waves to transfer data from a tag attached to an object for automatic object identification and tracking. Currently, RFID has been deployed in many industries and applications. For example, enterprises can manage stock and assets more efficiently (Meng, Chiu, et al., 2010) using RFID. Further combined with other mobile technology, it has a large potential for various ubiquitous applications.

Such emerging system architectures and computing paradigms bring new power to the engineering of systems, and provide opportunities in new application domains (such as aviation systems and services). However, they also bring ever increasing complexities that calls for innovations and standardization. In addition, social and legal issues of such emerging technologies and systems must not be ignored (Chiu, Kafeza, and Hung, 2011).

Chapter Introductions

To illustrate some theoretical and analytical advancement in this perspective, the third section of this book centers on mobile innovations and contains five chapters, which can be roughly divided into three categories: mobile user behavior, mobile services, and Radio Frequency Identification (RFID).

For mobile user behavior, Sell, Walden, & Carlsson (2011) explored the effect of life-style segmentation on mobile service users and found out five segments (namely skillful, efficient, trendy, basic, and social) that provide insight on how different users make use of mobile services. The findings are potentially important as mobile service providers do not appear to pay enough attention to consumer segments and the needs of the mobile service users.

For mobile services, Zhang, Yao, et al. (2011) propose to use a mobile-cloud by combining mobile devices and the cloud together in a Biodefense and Emerging Infectious diseases (BEI) research appli-
cation scenario. Mobile devices are used to collect data in order to be manipulated and to interact with the scientific workflows running in the Cloud. Their framework also features an independent trusted accountability service for providing data provenance and enforcement compliance among the participants.

Maamar, Faci, et al. (2011) propose to weave social networks into mobile commerce so that consumers, providers, and brokers are connected to one another through relationships such as competition, referral, loyalty, and collaboration. The value of social networks added to mobile commerce is illustrated with a set of experiments implementing a smart mobile restaurant guide.

For RFID, Zhang, Wang, et al. (2011) employ RFID enabled vehicular network as a cost-effective alternative to fixed infrastructure based wireless networks for offering ubiquitous communication capacity to moving vehicles. In this way, they provide effective Ubiquitous Travel Query services over Mobile Relay Network (MRN) to facilitate the needed information access for drivers on the road.

Last but not the least, Chiu, Mark, et al. (2011) employ RFID and mobile technologies to enhance Enterprise Resources Planning (ERP) systems for logistic process integration and remarkably enable comprehensive support for exception handling. Benefits include retrieving information more easily, reducing order processing and delivery time, increasing sales performance, enhancing communication with customer, and improving data accuracy.

**SUMMARY**

SOC has become an integral part of ICT infrastructure of modern organizations, governments, and even individual computing needs to facilitate the modeling, analysis, design, integration, development, and deployment of information systems and services. The tools and methodologies based on SOC generally provide cross-platform compatibility, agility, flexibility, and cost-efficiency (Chiu, Cheung, et al., 2010, Göschka et al., 2010). This in turn facilitates the achievement of intelligent and quality services in a wide range of application context.

Thus, the creation, operation, and evolution of the research and practice in SSOE raise concerns that range from high-level requirements and policy modeling through to the deployment of specific implementation technologies and paradigms, as well as involve a wide (and ever growing) range of methods, tools, and technologies. They also cover a broad spectrum of vertical domains, industry segments, and even government sectors.

We are continuously seeking collaborations and carrying out various scholarly activities, including workshops, conference special tracks, and journal special issues on this topic. Our efforts can be dated back to the first International Workshop on Service Intelligence and Service Science (SISS) held in Hong Kong, October 2006 and later in Beijing, China, September 2008. Following up is our book entitled “Service Intelligence and Service Science: Evolutionary Technologies and Challenges” (Leung, Chiu, & Hung, 2010) and a special issue on “Service Intelligence” in the *International Journal of Organizational and Collective Intelligence* (IJOCI) (Chiu, Hung, & Leung, 2010). Recently, the First International Symposium on Web Intelligent Systems & Services (WISS 2010), held in Hong Kong, December 2010, has accepted about 30 papers from various countries all over the world (Chiu, Bellatreche, et al. 2011). We further launched two special issues in the *International Journal of Systems and Service-Oriented Engineering* (IJSSOE) on “Intelligent Services” and “Intelligent Systems”, respectively (Chiu & Sasaki, 2011).
We also promote SSOE in more specific technological contexts such as mobile computing and cloud computing. For mobile computing, we founded the workshop on “Mobile Business Collaboration” in 2009, Brisbane, Australia, and continued it in 2010, Hong Kong, and 2012, Kun Ming, China. We have also founded our recent workshop on “Cloud Information System Engineering” (CISE) in 2010, Hong Kong (Chiu, Bellatreche, et al. 2011).

We have discussed a wide range of challenges and opportunities in this emerging field. These chapters illustrate some of the current research areas pertinent to System and Service-Oriented Engineering (SSOE); while, in many ways, also amplifying the many challenges, which remain to be addressed. It is expected that new topics will emerge while existing research will shift concentration into these areas in the coming years.

Therefore, we have tight collaboration with IJOCI and IJSSOE to provide an open, formal publication for high-quality research work developed by theoreticians, educators, developers, researchers, and practitioners across disciplines to advance the practice and understanding of contemporary theories and empirical analysis in the perspective of our emerging field towards the goal of achieving service excellence under the current globalized service-oriented economy.

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