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Towards Connecting Online Interfacing and Internal Core Business Processes

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Towards Connecting Online Interfacing and Internal Core Business Processes

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Abstract

Nowadays, organisations tend to do more business online by enabling their business processes to interact with customers, suppliers, etc., via different online channels. On the other hand, their core business processes, such as production, engineering, etc., may still stay inside the organisation. As a consequence, this makes an organisation rely on the collaboration between these two types of business processes to conduct its business, and this collaboration brings issues like multiple instance correlation, process view, and process evolution, to the business process management (BPM) of the organisation. This paper reports our research in progress on these issues. It firstly identifies the requirements to fully support such collaboration, and then presents a framework to illustrate how the collaboration can be facilitated using latest BPM technologies. This framework provides a reference architecture to incorporating online interfacing and internal core business processes.

Keywords

Online business process, process version management, process view, business process collaboration

1. INTRODUCTION

With the advancement of internet technologies, online operations have become more popular and embedded within our normal day-to-day activities. In developed countries, more and more people are interacting and living in a digitally enhanced world, as they increasingly work, shop, play and learn online. To accommodate these trends, many companies and government agencies are making their services available online using web-based portals, smart phone apps, and other facilities (Haines 2013). Despite these changes, most of the core business processes of these organisations still run internally without many online operations. These core business processes rely on many manual or non-automatic activities to realise their business functions, and therefore are not useful for responding instantly to customer requests.

In the current digital era, how to smoothly connect online interfacing business processes and internal core business processes becomes an issue for most organisations with legacy practices. However, linking and further automating these different processes is expected to enhance business efficiency and accelerate service delivery speed with minimal influence to the original cluster of business processes (Kobayashi, Tamaki, and Komoda 2003.). It is also expected that the overall success of this linking of processes will be contingent on the effective and efficient alignment of the different types of business processes that are brought together.

Background

Online interfacing business processes are increasingly popular as more organisations start to create online portals and handle transactions online. However, this effort tends to stop before addressing the challenges and smoothly incorporating online interfacing and internal core business processes, in spite that the efficiency of such incorporation significantly influences the success of the transformation towards online business (The Times 100 2013). A primitive attempt to this topic is that Wu et al. (2009) have discussed a process of implementing online and physical business processes from the perspective of strategy integration, where the necessity of seamless process incorporation has been highlighted for the first time.

On the side of infrastructural support to such process integration and process collaboration, a business process engine plays an important role, as it is the main system component in charge of initiating business processes, navigating the process instances to flow, etc. Such business process engines have

become a pivotal part of business process management systems since 80s. At that time they were designed to support traditional internal core business processes with classical transaction support. Later on when model-view-controller (MVC) and other similar design architectures emerged out, user interfaces are separated from a business process engine to enable a business process to interact with users through diverse and changeable interfaces (Weske 2007). As business complexity and diversity increases, business process engines are on demand to support features like supporting complex cardinality of collaborating business processes, run time evolution of business processes, privacy control during collaboration, etc., to enable process collaboration. (Liu, Li and Zhao 2009)

Aims and Organisation

The research in progress reported in this paper aims to fill this gap in knowledge regarding the incorporation of online interfacing and internal core business processes. It does so by examining the deployment of business process management in a typical online-frontend and offline-backend business environment. This paper firstly looks into the differences between online interfacing and internal core business processes, and then discusses the challenges involved when connecting these two types of business processes, and then analyses the potential facilitating methods. The remainder of the paper is organised as follows: Section 2 illustrates how online business processes serve customers, and summarises key characteristics of online business processes; Section 3 addresses the challenges of connecting online interfacing and internal core business processes and discusses possible supporting methods; Section 4 presents a preliminary framework for incorporating these two types of business processes; and finally the conclusion is given in Section 5 along with a discussion of our future work.

2. MOTIVATING EXAMPLE

A large local florist company struggled to increase its sales, as demand locally is flat. A consulting company suggested the florist company extend its distribution channel to online sales. Therefore, the florist company subsequently initiated an online sales portal, which enabled individual customers to place orders through the internet. The online portal is directly connected to the company's customer relationship management (CRM) system and workflow engine system. Thus, the online sales system can access a customer's previous historical CRM data and the created sales process instances can collaborate with backend production process instances. This shows a typical transformation case towards online sales.

Now, through the newly established sales portal, many individual customers can browse the products on sale, start a customer purchasing transaction, and trace the shipping status of their order. A young university student, Danny, finds the sales site and feels it is worth a try when he surfs the internet on his personal computer. As the mother's day is coming, he decides to order a bunch of carnations for his mother. On the sales portal, Danny checks the specifications, pictures and customer reviews of various types of carnations and decorations, and finally decides a specific type to purchase. Danny selects the proper flowers and accessories, and puts them into an online shopping cart, and inputs his delivery address, while the system returns the total amount to pay. When Danny attempts to finalise the transaction by entering the payment details, he suddenly realises his credit card is left at his locker in the university gym. Danny then goes to campus to get his credit card. While on campus, Danny continues the uncommitted transaction on his tablet. After submitting the order, Danny receives order confirmation and acknowledgement that any updates to the shipping progress can be viewed from the sales portal or sent directly to Danny's mobile phone.

The florist company receives hundreds of orders every day from individual customers just like Danny. With the support of a backend workflow engine, when each customer starts placing an order on the portal, a particular sales process instance is created to interact with the customer by recommending available products, maintaining the online shopping cart, finalising order submission, calculating amount of payment, etc. With the knowledge of previous customer transactions and behaviours obtained by the CRM system, each sales process instance is customised to better serve customers. For example, the sales process for a VIP customer include such activities as displaying exclusive offers, scheduling urgent delivery, etc. In contrast, the sales processes for general customers focus more on credit checking related activities. Thus, at any given moment there are often multiple sales process instances running, each one slightly different from each other.

In regard to flower processing, the company continues to use its well established flower handling process, which includes flower picking, cutting, decorating and packing. Different from the online sales process, this flower handling process does not operate online and involves many manual steps to run. The received orders are batched first before being sent to the flower handling process to capture

economies of scale. Consequently, one flower handling process instance makes the flowers for multiple sales process instances.

This example shows how an online sales process serves customers and collaborates with an internal flower handling process, where the former is more informational and latter is more physical. Though some hybrid business processes may own the features of both types, these two types represent most typical business processes of a company transforming to turn business online. Table 1 compares these two types of business processes in terms of orientation, lifecycle, etc.

Table 1. Comparison between interfacing business processes and internal core business processes

	Online interfacing business processes	Internal core business processes
Orientation	External party oriented	Internal operation oriented
“Weight”	Relatively lightweight, highly computerised	Relatively heavyweight, often involve more manual efforts
Lifecycle	Relatively short as such processes are initiated in a one-per-customer manner	Relatively long
Interface	Dynamic and flexible (via web, smart phone, tablets, etc.)	Relatively static and fixed
Number of instances	Often large	Relatively small

These different features result in some mismatches between the emerging online business processes and the traditional business process management systems mainly designed for internal core business processes. To well support the collaboration between these two types of business processes, special improvements are on demand to enhance current business process systems.

3. ISSUES ON CONNECTING ONLINE INTERFACING AND INTERNAL CORE BUSINESS PROCESSES

According to the identified differences between online interfacing and internal core business processes, this section continues to investigate how these differences challenge current business process management, as well as the potential management methods and technical support required for deployment.

3.1 Collaboration among Multiple Instances

In our case, an instance of a core business process may interact with multiple instances of an online business process. The collaboration between online business processes and core internal core business processes follows a many-to-one cardinality instead of the basic one-to-one relationship. For example, many individual customers may place orders online, and the orders from these sales process instances are handled by a single flower handling process instance. Further, this flower handling process instance may source materials from several suppliers using a number of procurement process instances, one for each supplier. Therefore, this collaboration involves multiple process instances, and the correlation among these process instances evolves as the collaboration proceeds. Yet, most current process modelling languages and business process management systems only support the one-to-one relationship (Zhao, et al. 2009). For example, WS-BPEL (Business Process Execution Language for Web Services) adopted special correlation sets to specify the correlations among collaborative process instances (OASIS WS-BPEL Technical Committee 2007). A correlation set specifies some common identifiable information, such as order number, consignment number, etc., and use them to determine the correlation between running process instances. Yet, as a pragmatic solution, a correlation set cannot guarantee the included instances completely and sufficiently describe the correlation. Discussion on other languages and systems are given in Section 5.

Such collaboration requires complex messaging and coordination support.

- Message multicasting. In the collaboration involving multiple process instances, the messaging relations between these processes may include one to many, many to one, and many to many, in addition to one to one.
- Correlation description. One collaboration involves multiple process instances, and one process instance may be involved in multiple collaborations, e.g., a product design process instance is part of the marketing collaboration and also part of the production collaboration.

Therefore, it is important to clearly describe such relationship among processes, instances, and collaborations.

- Dynamic correlation tracing. The correlation is not static, since process instances can join or leave the collaboration at run time as the collaboration proceeds. The correlation is therefore not possible to be specified at build time.

The support to multi-instance collaboration is highly coupled with a business process engine. The engine needs to be enabled to multicast messages to correlated instances and navigate the collaboration according to correlation knowledge. The support to process engine will be addressed in next section.

3.2 Co-existence of Multiple Process Versions

Massive customer-oriented online business processes can generate vast amounts of data on customer purchase behaviour and product preferences. From the perspective of process customisation, this data can be utilised to discover customer preference, product popularity, etc., and in turn such intelligence can help adapt the corresponding business processes to better serve the targeted customers. As an online business process interacts is fully customer-oriented, this customisation results in that a base online business process may evolve into many parallel versions with corresponding variants according to the individual needs, preferences or behaviours of different customers. Therefore, this requires comprehensive process version management, in addition to conventional business intelligence support.

In the example discussed in Section 2, an instance of flower handling process may receive orders from 50 sales process instances which serve 50 individual customers, respectively. Suppose, among these 50 sales process instances, ten are of the version for VIP customers; 30 are of the version for general repeated customers; and the other 10 are of the version for first time customers. In addition, this flower handling process instance may interact with several procurement process instances to source flowers and accessories from different suppliers. Thus, this collaboration involves multiple process instances of multiple versions. The business process management system needs to maintain the collaborating process instances, and manage the different versions of these processes and the version changes that have been made. These characteristics call for the following support for better business process management:

- Versions representing process evolution. This relates to the design of a versioning method to represent different process adaptations as well as the dependencies between version instantiations. Also, how to represent process evolution in terms of process structures, process data and involved roles.
- Run time process migration. When version shift occurs, all running instances of the original process version should be updated to the new one. This will lead to process migration between versions.
- Incorporation with support to multiple instances. The process collaboration is a multiple-version-multiple-instance scenario. The version support should be well coupled with multiple instance management.

Version management plays an important role in handling process changes, where process variation is a typical feature of online business processes. Owing to the customisation to massive individual customers, the number of possible process variants is often large. Rather than maintaining all customised processes, the base process and all applicable process variants should be stored in a more efficient way. The next section will cover this topic as well as other aforementioned ones.

3.3 Flexible Process Representation

As a typical method of separating process presentation from process execution, process view technology can be applied to online business processes, particularly for process tracking purpose.

A typical example is that an online customer may check the shipping progress after placing an order. This function relies on the status tracking of a running process instance. Process tracking is also very useful in the service outsourcing context, such as staff recruitment. For example, a potential applicant may check the progress of the involved position advertising process, interview process, and finalisation process. This example requires comprehensive tracking over multiple processes. Further, this tracking capability will be subject to information privacy and security constraints. The trackable part of a business process is determined by the relationship between the host company and the tracker. Therefore, owing to the various relationships, a business process can be perceived differently by

different trackers. This requires flexible representation of business processes to process users (trackers).

Such flexible process representation relies on well customisable and rigorous process transformation. The representation transformation should meet the 4C requirements, i.e., the transformed view of a process should preserve *consistent* structural information with the original process, with the transformed view the customer can still *communicate* and *collaborate* with the host organisation, and the transformed view should *comply* with the same set of rules/regulation applied in the organisation. To realise such 4C complaint view transformation, the following support is on demand.

- View transformation. A process view shows a part of the base business process. The view extraction/transformation should reflect the process perception of a given role, and this relies on precise descriptions of process perception and its influence to the visible process view.
- Structural consistency. The view transformation certainly will change the process structure. During the transformation, the transformed view should be kept consistent with the original one in terms of task execution order, control flow dependency, etc.
- Compliance to organisational environment. During process view transformation, the transformed view should be ensured to fit into the organisational environment in terms of role/resource assignment, work item/list mapping, business policy, etc.

Process view support is highly related to worklist handler, which is in charge of updating task lists and other related process information to process users for execution and monitoring/tracking purposes, respectively. With the process view support, such process information can be customised to adapt to different process perceptions of different users. The incorporation of process view support into a business process management framework is to be covered in next section.

4. FRAMEWORK TO FACILITATE THE CONNECTION OF ONLINE INTERFACING AND INTERNAL CORE BUSINESS PROCESSES

Last section has identified some issues to adequately supporting the collaboration between online interfacing and internal core business processes. According to these issues, a framework is introduced to present a preliminary solution to the incorporation of these two types of business processes. This framework is based on some of our previous work relevant to this topic.

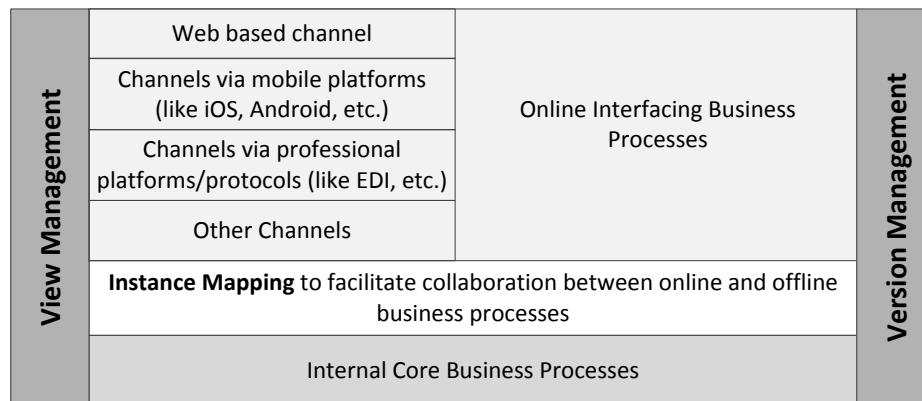


Figure 1. Architecture of incorporating online interfacing and internal core business processes.

Figure 1 shows the overall architecture of our proposed business process management scheme, where online business processes can interact with external users, e.g., customers via different channels, and core internal business processes stay inside of the company. A new version management layer is in charge of the version creation and evolution of all business processes, and a view management layer is in charge of transforming the views of business processes according to given perception constraints. Between the online interfacing and internal core business processes an instance mapping layer coordinates the collaboration between different instances of these two type business processes. Figure 2 depicts the architecture of the proposed framework in more technical detail.

As shown in Figure 2, *instance mapping management* module uses a *correlation database* to maintain the dynamic correlations between instances of online interfacing and internal core business processes. Correlations are recorded in the format of correspondences between one running process instance and a set of process instances correlated to the former. In this way, a many-to-many relationship is decomposed into combinations of one-to-many relationships. *Correlation tracer* monitors emerging

correlations, e.g., when an online ordering process instance passes an order to an internal production process instance these two instances are correlated. Correlation tracer is in charge of recording such correlations, and also reports instance correlations to the *engine* to navigate process collaboration.

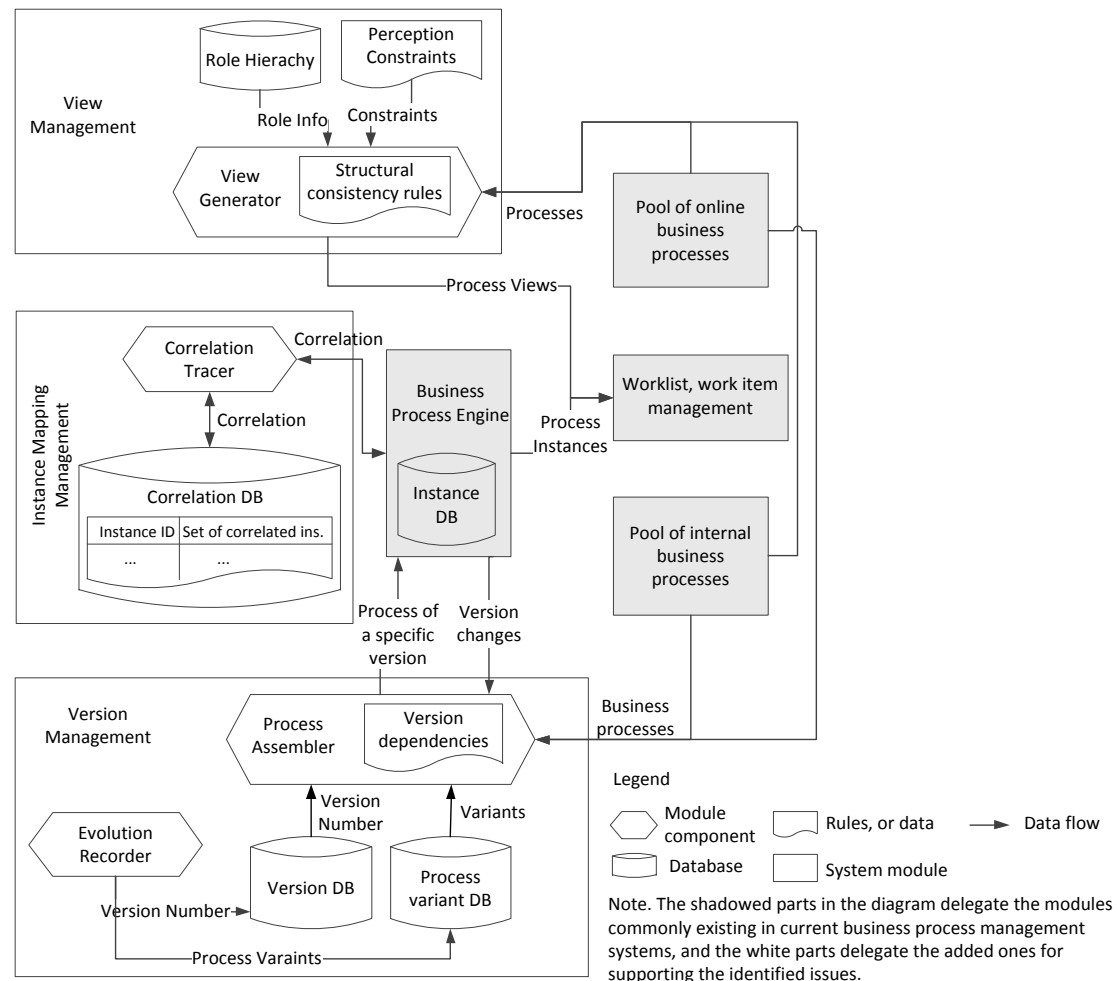


Figure 2. Architecture of enhanced business process management system

View management module works with *process pools* and *worklist and work item handler*. Based on *role hierarchy* information and *perception constraints* defined for different roles, *view generator* can create proper views for the business processes in pools. These process views will be passed to the worklist and work item handler to represent the pictures of involved processes perceivable to specific users.

Version management module contains an *evolution recorder*, which records any occurred process changes to *process variant database* and assigns a proper version number to *version database*. Based on the information stored in these databases, *process assembler* can derive out an evolved business process (specified by a given version number) from the base business process obtained from process pools. This derived business process can be fed into the engine to be initiated for execution. Because the evolution of online business processes is often customer-oriented, the number of evolutions could be very large, compared to the relatively static base business processes in the pool. The separation of base and evolved business processes can effectively keep the process space concise and support the diversity of evolution.

The operation of this enhanced business process management system relies on the following mechanisms;

- (1) Run-time instance correlation tracing and maintaining. Tracing the instance correlation changes at run time, store and relate them to participated collaborations.
- (2) Version designation. This designation should map process version numbers to process changes in form of process variants.

- (3) Process assembling. For a given process version number, assemble a business process from a base business process by applying all related process variants.
- (4) Perception description in business process context. Representing the process perception of a role, and the perception dependency according to the role hierarchy.
- (5) View transformation. Create process views according to the given perception constraints and structural consistency rules.

The development of these mechanisms will build on our previous work in related areas. For point (1), our previous work (Zhao and Liu 2010) has touched the cardinality issue in multiple-instance collaboration. A Petri-net based model has been proposed to represent the build-time process cardinality. This model deploys a special data structure and tracing mechanisms to capture the changing instance correlations at run time. In regard to point (2) and (3), a process versioning method has been proposed in our work (Zhao and Liu 2013) to map version numbers to parallel alternative evolutions and permanent evolutions. Process evolutions are thereby recorded in both version space and schema space. A version preserving graph reserves all process variants in a special graph, and can support process extraction for a given version number. For point (4) and (5), our previous collaboration projects with SAP Research (Zhao et al. 2011) have tackled process perception and process view definition, and developed the preliminary process view transformation operations using classical process change patterns.

Based on this foundation, our framework will focus on incorporating the existing works together, particularly on facilitating the process collaboration in such a multiple instance and multiple versions environment. In addition, more contents will be added to the rule set for restricting process view transformation in terms of compliance to organisational context.

5. RELATED WORK

According to a recent report by Gartner Research (2013), the market value in 2011 for business process management technologies was \$2.4 billion with a projected 9.65% growth rate up to 2016. A large drive to this growth is the boost to business efficiency and output. In the background that online activities further blended in our everyday life, the connection between online interfacing business processes and internal core business processes has emerged out as a key topic to business process management. Though the topics is relatively new, some initial research efforts have been put in the supporting technologies, such as multiple instance collaboration, process views and process version management.

Multiple instance collaboration

Multiple instances have been conceptually discussed in work on workflow patterns and service interaction patterns. van der Aalst, ter Hofstede, Kiepuszewski, and Barros (2003) deployed coloured Petri nets to represent six categories of workflow patterns. Especially for “Patterns involving Multiple Instances”, particular mechanisms were proposed to track instance identities and synchronise them with high level Petri net model. Instead of multiple instances of a workflow process, these patterns handle the multiple instances of a sub process belonging to a workflow process. Multiple workflow instantiation was discussed by Dumas and ter Hofstede (2001). The concept of multiple instances mainly denotes the multiple execution of one workflow activity, and therefore the proposed synchronisation techniques are for parallel activity instances, such as N-out-of-M join. Mulyar, Aldred, and van der Aalst (2007) investigated the message multicasting patterns in service interactions. Their research took into account the factors of message queuing, sorting and indexing, possibilities of non-responding parties and missing replies, etc. Nevertheless, most of above research focus on interaction patterns, and sidestep the instance correspondence issue in collaborative business processes.

In BizAgi BPM suite (BizAgi 2009), a database table relationship diagram was adopted to represent the cardinality between attributers of different entities. This diagram largely focuses on the entities involved in processes, like clients and applied loans, a client’s city and country information, etc., rather than processes themselves. Consequently, this diagram only indirectly represents the cardinality between business processes, and it is short of run-time correlation support. Based on the limited published documents, other commercial BPM softwares, such as IBM WebSphere (IBM), Tibco (TIBCO), etc., seem to adopt a pragmatic method, i.e., recording run-time instance correspondences in a backend database table. Yet, this simple recording mechanism lacks analysis capability, and therefore, few of these BPM softwares support build-time correspondence simulation or verification.

WS-BPEL (OASIS WSBPEL Technical Committee, 2007) used a set of explicit identifiers, a.k.a., correlation sets, to correlate process instances by checking if the identifiers of these instances have the same value. Some commercial BPEL engines, such as SAP NetWeaver Process Integration (SAP) and IBM WebSphere Process Server (IBM 2005) realise this correlation by attaching extra identifiers, like message ID, message source and target, etc. Nevertheless, WS-BPEL defines a business process from the perspective of a pivot organisation, and therefore it only represents the interactions between the pivot organisation and its neighbouring organisations. This feature limits its application to the collaboration involving non-neighbouring organisations. In work AO4BPEL, Charfi and Mezini adopted aspect-oriented programming paradigm into Web service composition by extending WS-BPEL (Charfi and Mezini 2007). Though their work mainly focuses on crosscutting dynamic changes, the proposed weaving mechanism covers the mapping and delivery of requested aspects to proper BPEL instances. This mechanism however relies on pre-defined join points and does not address the correspondence between BPEL instances.

Process views

The “visibility line” of business has been first discussed in 80’s from the pure business perspective (Shostack 1984). With the prevalence of process-oriented management, the incorporation of process views into business process management becomes an inevitable trend. Schulz and Orłowska (2004) focused on the cross-organisational interactions, and proposed to deploy coalition workflows to compose private workflows and workflow views together to enable interoperability. Chiu et al. (2004) adapted the view concept from database systems, and employed a virtual workflow view to hide internal information. The virtual workflow view only presents the information necessary for process enactment, enforcement and monitoring, instead of all details. In regard to process interoperability within virtual enterprises, Perrin and Godart (2004) used synchronisation points between process services to coordinate collaboration, and thereby allowed partners to personalise their internal processes without affecting the cooperation. Issam et al. (2006) extracted an abstract workflow view to describe the choreography of a collaboration scenario and compose individual workflows into a collaborative business process, and in that way partial visibility of workflows and resources are enabled.

Process structural consistency is an important constraint for process view transformation. Liu and Shen (2004) proposed an order-preserving approach to derive a structurally consistent process view from a base business process. In their approach, the generation of “virtual activities” (compound tasks) need to follow their proposed membership rule, atomicity rule, and order preservation rule. Eshuis and Grefen (2008) formalised the operations of task aggregation and process customisation, and also proposed a series of construction rules for validating the structural consistency. Most of these researches concentrated on process view filtering only, but not view merging. Ploesser et al. (2008) have investigated the techniques for consolidating and merging processes from the perspective of process change and version management. With this perspective, their work focuses on how to merge the changes made by different process users to the same business process, rather than dynamically generating/updating process perceptions according to interactions among process users.

Process evolution and version management

Process evolution has been addressed in work around flexible/adaptive business processes. Hamadi and Benatallah (Hamadi and Benatallah 2004) proposed a self-adaptive recovery net (SARN) to support workflow adaptability during unexpected failures. In Sadiq et al.’s work on flexible workflows (Sadiq et al. 2005), concept “pockets of flexibility” was proposed to allow ad hoc changes and/or building of workflows. With a focus on organisational factors, BPM group at QUT has extended event-driven process chain (EPC) to represent a range of variations in terms of roles and objects that are associated to tasks (La Rosa et al. 2011). Yet these researches largely concentrate on reference models for process changes, but lacks operational support for process configuration and composition.

As a key tool for process evolution management, version control has recently caught increasing attention. Lee, D. et al. have proposed a timestamp based approach, which assigns process versions with creation time of process version (Lee et al. 2008; Rosado et al. 2006). As the time sequence cannot be overlapped, this approach fails to represent concurrent versions. Kradolfer and Geppert (1999) presented a framework for dynamic workflow/process schema evolution based on workflow type versioning and workflow migration. Version trees were proposed to represent workflow schema evolutions, and to keep track of the resulting history. Nevertheless, the version management is still limited. Typically, to re-assign a previous version to a running workflow instance, this method has to perform a series of inverse modification operations along the version tree to achieve that version.

6. CONCLUSION AND FUTURE WORK

Aiming to facilitate the incorporation of online interfacing and internal core business processes, this paper has looked into the characteristics of these two types of business processes, as well as the collaboration between them. Three major challenges have been identified, viz, flexible process representation, collaboration among multiple instances, and dynamic process evolution. According to these challenges, a framework has been presented to provide a reference architecture for facilitating the collaboration between online interfacing and internal core business processes.

The presented work reports the current status of our research, and the planned future work includes further defining the framework, developing mechanisms for regulating process view transformation in terms of compliance to organisational context, and prototype implementation.

REFERENCES

- BizAgi. 2009. "Wiki.Bizagi: Process Data." (http://wiki.bizagi.com/en/index.php?title=Process_Data).
- Charfi, A., and Mezini, M. 2007. "AO4BPEL: An Aspect-Oriented Extension to Bpel," *World Wide Web Journal* (10:3), pp 309-344.
- Chiu, D.K.W., Cheung, S.C., Till, S., Karlapalem, K., Li, Q., and Kafeza, E. 2004. "Workflow View Driven Cross-Organizational Interoperability in a Web Service Environment," *Information Technology and Management* (5:3-4), pp 221-250.
- Dumas, M., and ter Hofstede, A.H.M. 2001. "UML Activity Diagrams as a Workflow Specification Language," *the 4th International Conference on the Unified Modeling Language, Modeling Languages, Concepts, and Tools*, Toronto, Canada, pp. 76-90.
- Eshuis, R., and Grefen, P. 2008. "Constructing Customized Process Views," *Data & Knowledge Engineering* (64), pp 419-438.
- Gartner. 2013. "Australian Organizations to Spend A\$70 Million on Business Process Management Suites in 2013," (<http://www.gartner.com/newsroom/id/2469315>).
- Haines, B. 2013. "9 Reasons to Put Your (Offline) Business Online," ([Http://Onlinebusiness.about.com/Od/Onlinebusiness101/a/9-Reasons-to-Put-Your-Offline-Business-Online.Htm](http://Onlinebusiness.about.com/Od/Onlinebusiness101/a/9-Reasons-to-Put-Your-Offline-Business-Online.Htm))."
- Hamadi, R., and Benatallah, B. 2004. "Recovery Nets: Towards Self-Adaptive Workflow Systems," in: *the 5th International Conference on Web Information Systems Engineering*. Brisbane, Australia: pp. 439-453.
- IBM. "Business Process Management Notation (BPMN) Style Diagrams." *WebSphere Business Modeller, Version 6.1, Manual* Retrieved 23/10/2012, from <http://publib.boulder.ibm.com/infocenter/dmndhelp/v6r1mx/index.jsp?topic=/com.ibm.btools.help.modeler.doc/doc/concepts/modelements/BPMnotation.html>
- IBM. 2005. "IBM Websphere Business Integration Server Foundation V5.1 Handbook," (<http://www.redbooks.ibm.com/redbooks/pdfs/sg246318.pdf>).
- Issam, C., Schahram, D., and Samir, T. 2006. "The View-Based Approach to Dynamic Inter-Organizational Workflow Cooperation," *Data & Knowledge Engineering* (56:2), pp 139-173.
- Kobayashi, T., Tamaki, M., and Komoda, N. 2003. "Business Process Integration as a Solution to the Implementation of Supply Chain Management Systems," *Information & Management* (40:8), pp 769-780.
- Kradolfer, M., and Geppert, A. 1999. "Dynamic Workflow Schema Evolution Based on Workflow Type Versioning and Workflow Migration," in: *International Conference on Cooperative Information Systems*. Edinburgh, Scotland: pp. 104-114.
- La Rosa, M., Dumas, M., ter Hofstede, A.H.M., and Mendling, J. 2011. "Configurable Multi-Perspective Business Process Models," *Information Systems* (36:2), pp 313-340.
- Lee, N., Kim, D., Kim, M., and Kang, S. 2008. "A Version Management Method for Managing Business Process Changes Based on Version-Stamped Business Process Change Patterns," in: *the 3rd International Conference on Innovative Computing Information and Control*. Dalian, China: p. 243.
- Liu, C., Li, Q., and Zhao, X. 2009. "Challenges and Opportunities in Collaborative Business Process Management," *Information System Frontiers* (11:3), pp 201-209.
- Liu, D.-R., and Shen, M. 2004. "Business-to-Business Workflow Interoperation Based on Process-Views," *Decision Support Systems* (38:3), pp 399-419.

- Mulyar, N., Aldred, L., and van der Aalst, W.M.P. 2007. "The Conceptualization of a Configurable Multi-Party Multi-Message Request-Reply Conversation," *the 9th International Symposium on Distributed Objects and Applications*, pp. 735-753.
- OASIS WS-BPEL Technical Committee. 2007. "Web Services Business Process Execution Language Version 2.0" (<http://docs.oasis-open.org/wsbpel/2.0/OS/wsbpel-v2.0-OS.html>).
- Perrin, O., and Godart, C. 2004. "A Model to Support Collaborative Work in Virtual Enterprises," *Data & Knowledge Engineering* (50), pp 63-86.
- Ploesser, K., Recker, J., and Rosemann, M. 2008. "Towards a Classification and Lifecycle of Business Process Change," *the 9th Workshop on Business Process Modeling, Development, and Support*, Montpellier, France.
- Rosado, L.J.A., Márquez, A.P., and González, J.M.F. 2006. "Representing Versions in Xml Documents Using Versionstamp," in: *4th International Workshop on Evolution and Change in Data Management*. Tucson, AZ, USA: pp. 257-267.
- Sadiq, S.W., Orlowska, M.E., and Sadiq, W. 2005. "Specification and Validation of Process Constraints for Flexible Workflows," *Information Systems* (30:5), pp 349-378.
- SAP. "Sap Business Workflow and Webflow Documentation."
- Schulz, K.A., and Orlowska, M.E. 2004. "Facilitating Cross-Organisational Workflows with a Workflow View Approach," *Data & Knowledge Engineering* (51:1), pp 109-147.
- Shostack, L. 1984. "Designing Services That Deliver " *Harvard Business Review* (62:1), pp 133-139.
- The Times 100. 2013. "Combining an Offline and Online Business - an Amway Case Study. (<http://Businesscasestudies.co.uk/Amway/Combining-an-Offline-and-Online-Business>)."
- TIBCO. 2012. "TIBCO Activematrix Bpm: Business Data Services Guide." (https://docs.tibco.com/pub/activematrix_bpm/2.1.0_february_2013/doc/pdf/tib_amx_bpm_bds_developer.pdf).
- van der Aalst, W.M.P., ter Hofstede, A.H.M., Kiepuszewski, B., and Barros, A.P. 2003. "Workflow Patterns," *Distributed and Parallel Databases* (14:1), pp 5-51.
- Weske, M. 2007. *Business Process Management: Concepts, Languages, Architectures*. Springer.
- Wu, I.-L., Fu, C.-Y., and Lee, C.-W. 2009. "A Process for Implementing Online and Physical Business Based on a Strategy Integration Aspect," *the 11th International Conference on Enterprise Information Systems*, J. Cordeiro and J. Filipe (eds.). Milan, Italy, pp. 5-11.
- Zhao, X., and Liu, C. 2010. "Steering Dynamic Collaborations between Business Processes," *IEEE Transactions on Systems, Man and Cybernetics, Part A* (40:4), pp 743-757.
- Zhao, X., and Liu, C. 2013. "Version Management for Business Process Schema Evolution," *Information Systems* (38:8), pp 1046-1069.
- Zhao, X., Liu, C., Yang, Y., and Sadiq, W. 2009. "Aligning Collaborative Business Processes: An Organisation-Oriented Perspective," *IEEE Transactions on Systems, Man and Cybernetics, Part A* (39:6), pp 1152-1164.
- Zhao, X., Liu, C., Yang, Y., and Sadiq, W. 2011. "Corpn: Managing Instance Correspondence in Collaborative Business Processes," *Distributed and Parallel Database* (29:4), pp 309-332.

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