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Olivera Marjanovic

School of Information Systems, Technology and Management, University of New South Wales, Sydney

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Process-Oriented CRM Enabled by Component-Based Workflow Technology

Olivera Marjanovic

School of Information Systems, Technology and Management, University of New South Wales
Sydney, Australia
o.marjanovic@unsw.edu.au

Abstract

To remain competitive, companies are starting to organise their work around customer-centered business processes that cross functional and organisational boundaries. Customer-relationship management is becoming more important than ever before. This paper proposes a new type of process-oriented CRM system suitable for Small-to-Medium Enterprises (SMEs) seeking to integrate a large number of service providers and services and create an added value for their customers. Process-support is enabled by component-based workflow technology. Design of this system is based on a flexible model of declarative business processes that is also briefly described in the paper. To illustrate the importance of the proposed type of CRM support, the paper uses an example of an Australian service-oriented SME .

1. Introduction

In recent times, more and more companies are starting to organise their work around business processes rather than individual, often isolated, tasks. These processes are designed to cross intra- and inter-organisational boundaries and integrate people, information and other resources as well as to include external parties such as suppliers and other business partners.

In the past, the main objective of business process support was to improve process efficiency by process automation. However, over the last decade this objective has significantly changed and now the main emphasis is on business process effectiveness. Furthermore, business processes are becoming increasingly customer-oriented. As Moore (2002) pointed out, "Visionary companies will proactively foster collaboration, share knowledge and organise around customer-centric processes. All organisations will eventually move in this direction, but risk losing competitive advantage if they delay too long" (Moore, 2002).

At the same time, customers are given more choices but, in turn, also expect more information, customisation, recognition and personalisation when dealing with a company. In the environment where another competitor is just “a click away”, the main goal for every business is to retain its customer base.

Consequently, management of customer’s relationships with the company is becoming even more complex. This is especially evident in service industries where businesses seek growth by providing an ever-increasing number and variety of services to their customers, usually in the form of “one-stop-shop”. For example, a large health service provider group can incorporate a number of related services and associated service providers hospitals, medical centers, diagnostic imaging centers, pharmacies, rehabilitation centers etc. Similar examples can be found in finance and banking, travel and tourism and other service-oriented industries.

From the customer perspective, this means that they need to deal with a large number of different service providers. So an important area of improved customer service is organization and personalisation of customer’s activities with different service providers. This may not be such a big issue with large companies as they often have integrated systems that make customer’s “navigation” and selection of services much easier (e.g. various company-wide appointment and scheduling systems).

However, this type of customer support is becoming more important in service-oriented SMEs (Small to Medium Enterprises). One such example is health and fitness industry that is currently considered to be one of the fast growing service industries in Australia. Although there are several examples of large international chains operating in Australia, this industry is largely dominated by SMEs. A typical medium-size health club can involve dozens (or in some cases close to a hundred) services and their providers. In order to create personalised programs for the customer, these services and service providers need to be integrated. This problem creates the need for different type of customer support and makes customer-relationship management even more complex. At the same time, the existing type of CRM systems (such as analytical, collaborative and operational) cannot provide the required support.

This paper further investigates the problem of service integration and customer’s “navigation” in service-oriented SME. It then proposes a new type of process-oriented CRM system enabled by component-based workflow technology. Design of this system is based on a flexible model of declarative business process that is also briefly described in this paper. To illustrate the importance of the proposed type of CRM support, the paper uses an example from a service-oriented SME in Australia.

2. An Overview of CRM: Customer Relationship Management

In today’s world, the term CRM tends to be associated with software applications designed to manage organisation’s relationships with its customers. In reality this term encompasses much more. It is a business approach that recognises that customers are the core of the business and that a company’s success depends on effectively managing their relationship with them (Brown, 2000). CRM is about building long-term and sustainable customer relationships that add value both to the customer and the company (Kalakota and Robinson, 1999).

The actual implementation of CRM varies from simple collection of customer feedback to sophisticated business strategies that allow customers to become an integral part of company’s decision-making process. In fact, the recent developments in the area of ambient organisations place even greater emphasis on customers and creation of customer-centered business processes. According to Bjorn-Andersen ambient

organizations are “customer-oriented organisations where customer intimacy, customer retention, product and customer segmentation and viral marketing (customers influence potential customers through stories of positive experiences with the products of the ambient organisation” (Bjorn-Andersen, 2003a). Therefore, in ambient organizations customers are treated as virtual resources (not on company’s payroll) and even “business partners” that get involved in some of the company’s business functions such as for example marketing or product design.

In terms of IT support, there are three different types of the existing computer-supported CRM (Turban, 2004):

Analytical CRM: The main objective of this type of CRM system is to collect, analyse and present data about customers and their interaction with the company. This is then used to assess customer satisfaction, better understand their needs, predict their behaviour in the future as well as provide decision support for marketing, sales distribution and customer service. Analytical CRM often uses a combination of data mining and data warehousing technologies to store and “mine” customer data in order to identify patterns.

Collaborative CRM: The main objective of this type of technology is to enable various departments in a company (such as sales, technical support, marketing) to share information about customers. For example, customer feedback gathered from a technical support session could inform marketing staff about products and services customers are interested in. This type of CRM uses collaborative tools such as e-mail, conferencing, chat tools etc. to enable collaboration and information sharing within an organisation at personal, team and enterprise levels.

Operational CRM: This type of CRM system focuses on automating the so-called “front-office” business processes. These are processes initiated by the customers and include customer interaction with technical support, sales and marketing department. The main objective of this type of support is to improve the overall efficiency of doing business between customers and the organisation, in particular customer technical support, marketing and sales processes.

In recent times, as companies place greater emphasis on integrated business processes, CRM systems come as fully integrated solutions combining analytical, collaborative and operational types of systems (METAGroup, 2004). Although, there are several commercial examples of powerful, integrated CRM systems on the market, their complexity and number of offered features make them much more suitable for large organizations. They are usually too expensive and far too complex (in terms of their provided functionality) for a typical SME.

This paper proposes a new type of process-oriented CRM suitable for service oriented SMEs where a typical customer is confronted with a large number of service providers that need to be selected and integrated. The proposed type of CRM provides simple and flexible service integration in order to enable personalised, customer focused business processes. The following section introduces a motivating example of a service oriented SME that has experienced the need for such CRM support.

3. Motivating Example

As already pointed out, health and fitness industry is one of the fast growing and very competitive service-industries in Australia. So far, this industry has been dominated by SMEs and sole traders. However, compared to other service industries in Australia (such as for example finance, travel etc.), this particular industry has been very slow to adopt innovative e-business application.

A motivating example for this research comes from a service-oriented SME called The UNSW Lifestyle Centre. Although located at University of New South Wales (UNSW)' premises, this is a commercial SME. This organisation was launched in June 2004 with the mission to set national standards for provision of a balanced and holistic approach to lifestyle management, health and wellbeing through quality programs, research and strategic partnership with industry.

This organisation employs a relatively small number of permanent staff members and a large number of independent service providers (fitness instructors, personal trainers, physiotherapists, nutritional specialists etc.). They offer a very large number of face-to-face services and number and types of these services are likely to grow in the future even more. In addition to individual services, this company offers personalised programs (e.g. rehabilitation program, weight management program etc) designed for individual customers.

From the process perspective, design of a program involves a number of steps. First of all, a client meets with a Lifestyle adviser with required expertise. Then, advisor assesses and profiles customer's health needs, time and financial constraints and – most importantly – their lifestyle goals. The adviser then uses this information to select a number of different services and combine them into a personalised program to meet the client's specific needs. A typical program includes a number of different services and service providers. Therefore, in addition to access to customer data, an advisor needs support to select services, integrate them into a program and then monitor each program execution and, if necessary, modify the existing services or add or change service providers. However, the complexity of service coordination and integration has to be hidden from customers as they deal with the Lifestyle centre rather than a number of independent service providers. At the same time, the overall process has to remain transparent for the client, as they should be able to monitor process execution and even request a possible modification.

Due to the required professional expertise as well as potential legal and ethical issues, customers are not allowed to design their own program. Therefore, program advisors play an important role that cannot be replaced by an expert system that could design, for example an injury rehabilitation program.

Service providers work with a large number of customers (i.e. participate in many different programs). They also need support to monitor program execution for each customer so they can better understand their specific needs.

So how do service-oriented SMEs typically deal with this problem? For example, different service providers may have different scheduling systems that need to be integrated. However, even a shared scheduler does not solve the problem because it does not provide process support (e.g. modeling and verification of process models, monitoring of process execution etc.). Large organisations may use a proprietary, distributed appointment system (typically used in large service-oriented organizations such as hospitals). Such system would not be suitable either because it would require each service provider to have access and use the same system. In this case this is not feasible because some service providers are mobile and work for more than one organisation and cannot be expected to adopt different systems to deal with different organisations. Some service providers do not use any technical support but their services still need to be selected and integrated into a program.

In summary, it is important to observe that to effectively support this type of process it is necessary to have much more than a scheduling system. What is needed is a new type of process-oriented CRM designed to integrate different service providers and services they offer, as well as provide a set of tools to all participants in the process (customers, program advisors and service providers). The core of this system is coordination support

that needs to be flexible to allow process model to change during run-time to better suit the needs of a particular customer. At the same time, service integration has to be simple for service providers as well, as they don't have the time or resources to invest into complex, proprietary solutions. The system should also allow easy integration of any new services or service providers in the future.

4. Integration Technologies – Current Capabilities and Limitations

This section gives a brief overview of the existing integration technologies and explains why these solutions cannot be used to support the requirements identified in the previous section.

4.1 Workflow Technology

Workflow technology has been widely recognised as one of the most influential business technologies and certainly the leading process-oriented technology (WFMC, 2001). Workflows are designed to specify, execute, manage, monitor and streamline business processes by allocating the right task to the right person at the right point of time along with the resources needed to perform the assigned task.

Workflow design and implementation involve *modeling* (also called built-time) and *execution* (run-time) phases. Briefly, during workflow modeling, individual tasks, actors and tasks dependencies are identified and combined in a business process model according to the corresponding business rules. It is important to note that workflow models are created by workflow analysts (i.e. process experts) and not end-users. Also workflows are designed from the business rather than customer's perspective. That means that the details of the actual process execution (e.g. tasks and their order) are usually hidden from the customers.

In most cases, the workflow modeling techniques and languages emphasise the control-flow perspective i.e. the ability to pre-specify tasks and their order (via control flows). That is why these models are often called *control-flow* oriented models.

Furthermore, workflow models are executable models. Although their graphical modeling language is similar to, for example, state transition diagrams, they are not just static conceptual models of business processes. Once such a model is specified during the modeling phase it is stored in the workflow repository ready to be executed (used) without any programming involved.

During run-time, a number of different process instances are created on the basis of the same model. For example, a model of the business process "Loan Approval" is created during built-time and stored in workflow repository. Then during run time, a separate process instance is created for each customer applying for a loan.

The actual execution of process instance and coordination of individual tasks during run-time is enabled by workflow engine. It uses the stored model to activate the required tasks if their activation conditions are satisfied. However, the actual details of task execution are out of the scope of the workflow system as task execution is "delegated" to human agents or software tools. Thus, via this task coordination mechanism, workflow technology enables integration of different tools and technologies used to support the individual tasks. For this reason, workflow technology is also considered to be one of the leading process *integration* technologies (WFMC, 2001).

It is obvious that the fully automated coordination mechanism works only if the process model is predefined. It is always possible to use this model to determine what should

happen next during process execution. This is the case with repetitive highly structured business processes.

Even though task coordination is fully automated, workflows still significantly differ from job-shop scheduling systems. Here, human agents still *participate* in decision making related to the individual tasks. However, all possible outcomes (decisions) are known in advance and pre-defined by the workflow model.

Only recently, the workflow community has started to concentrate more and more on the business processes where models (including coordination structures) cannot be fully specified in advance. The examples include work in the area of flexible and adaptive workflows (see for example (Reichert et. al. 1998)) and emergent workflows (see for example (Carlsen and Jorensen, 1998)). The main limitation of both approaches is that up to now, both adaptive and emergent mainly focus on control flow oriented models.

There are several reasons why workflow technology cannot be used to provide the required process support (as identified in the previous section). First of all, workflow models are not flexible enough to provide the required service integration. The model has to be defined in advance and stored in the repository. It is then executed by workflow engine that follows pre-defined control flows. However, in the process-oriented CRM, as described in the previous motivating example, service providers and individual services can easily change during process execution. Also customer's requirements can also change. Therefore, much more flexibility is required.

Furthermore, while workflow models are designed by workflow analysts, in this case process models are designed by end-user (program adviser) for another end-user (client). From the usability point of view this has a number of implications: modeling language must be simple; users should be able to easily verify consistency of the created model (e.g. check if it is possible to complete all tasks by a given deadline); simulate process execution; and so on.

To makes things even more complex, the components of a process model (individual services) are also defined by the third type of end user (service provider). So they need support to describe and register their services in a simple way that is descriptive enough to enable the coordination mechanism to detect and integrate them into the required program.

4.2 Web Services

Web services are self-contained, modular Internet based applications, offered by different providers that have a standard interface to enable efficient integration and implementation of complex business applications. Recent reports by various leading industry analysts and practitioners claim that web-services are going to revolutionise the existing IT applications as they enable easy integration of different platforms, tools and resources (Zhang, L-J, 2004), (Yang, 2003). The integral part of web services is a set of enabling XML-technologies that includes Web Services Description Language (WSDL), Simple Object Access Protocol (SOAP), and Universal Description, Discovery and Integration (UDDI) protocol. They are used to describe standardised characteristics of web services, communication between web services as well as web service registry and discovery mechanisms.

Composite web services enable flexible, on-demand integration of individual services offered by different providers, to meet a specific business objective. This integration is made possible by the fact that web services are platform neutral so as long as they comply with the web service standard they can be integrated. From the business perspective,

composite web services enable integration and implementation of complex, dynamic inter-organisational business processes.

As this is an emerging field, there are many research and developmental challenges yet to be solved such as, for example interoperability issues, business semantic computing etc. (Zhang, 2004). As the web service infrastructure is reaching its more mature stage, more and more researchers are starting to recognise the importance of modeling of the web service business context. This includes modeling of business entities and their relationships, which is necessary for web service composition. In fact, according to (Zhang and Jackle, 2003), modeling of the business context is the key requirements for composition and execution of business processes made of composite web services. Especially in the area of dynamic composition of web service flows, which is also called web service orchestration. Consequently, this has become a hot research topic in the area of web service modeling (Zhong, 2004).

Currently available standards for service orchestration are mainly based on the control-flow paradigm inherited from traditional workflows. During the execution of a control-flow oriented model, service orchestration is fully automated. Therefore, upon completion of one service its outgoing control flows are used to determine the next service(s) similar to the workflow engine. For example, the control flows are best represented at conceptual level by using flow charts, UML activity graph etc.

Irrespective of the actual version of conceptual modeling language, all control-flow oriented models of web service orchestration, have inherited a number of problems from their predecessors – workflow models. First of all, the control flow models are *procedural* models where control flows prescribe the procedure for model execution including the order of individual web services. Consequently, all process components have to be specified in advance, before the model could be executed (normally during the modeling phase). This is suitable for business partners with very well established and mutually agreed process models. This modeling paradigm is not flexible, nor dynamic enough to suit the needs of web service composition and orchestration especially in dynamic markets where business partners and the process models can easily change. Hanson et al (2001) (as cited in (Peltz, 2003)) illustrate the same point by using an interesting analogy. They compare the currently available models for web service orchestration to a vending machine with a set number of buttons that can be only pressed in a predefined order. What is needed is more flexible model analogous to a telephone call that involves a series of exchanges between parties at each end in a more flexible dynamic fashion. Therefore, web services based on the current control-flow oriented standards cannot offer the required flexibility to implement process-oriented CRM.

Furthermore, modeling of a composite service at the conceptual level (by non-specialists) is a real research challenge. In fact, the current experience with conceptual modeling of a composite service in the business domain illustrates that, as technologies and infrastructures are becoming available, the gap is widening between the available technology and our current understanding of process modeling, verification, orchestration and monitoring. In other words, modeling of the process (made of composite web services) and its context are currently the major research problem in the area of web-services (Zhang, L-J, 2004).

Finally service providers cannot be expected to model and describe their services by using any of the existing web service modeling languages (such as WSDL). As already pointed out, they require different, simpler, but more flexible solutions.

5. Process-Oriented CRM Enabled by Component-Based Workflow

As already pointed out, this paper proposes a new type of process-oriented CRM suitable for SMEs dealing with large number of independent services providers whose services need to be integrated in order to create customer's value. This section summarises the theoretical model used for design of process-oriented CRM as well as a high level architecture of component-based workflow used for its implementation.

5.1 Theoretical Model

Design of a process-oriented CRM is based on a declarative model of a business process. This conceptual model was first introduced by (Marjanovic, 2003). Due to its flexibility, this model can be used for different types of business processes ranging from highly structured, via semi-structured to unstructured. This section gives a very brief overview of the declarative model.

Recall that control-flow models (such as workflow model) consist of tasks linked by control flows. These models are suitable for business processes that are highly structured where all components can be defined in advance.

A declarative model of business processes is based on a concept of a *state* and does not use any control flows. More precisely, a business process used here consists of a number of services (provided by different service providers). The same service can be used by many different process instances. For each process instance, a service goes through a number of states as follows:

- *Inactive*: All services are initially *inactive* (yet to be selected and integrated into a program).
- *Selected*: The next stage occurs when an individual service is selected (in this case by program advisor). The same service can be included in a number of different programs. So each time a particular service is selected, a new instance of service is created for a particular customer. Therefore, each service in the *selected* state is an instance of its corresponding service in *inactive* state.
- *Active*: During execution of a particular program, services are activated if their corresponding conditions are satisfied. Note that the same service can be used (activated) over and over again by the same customer, within a single program. However, the same service cannot be both in the *selected* and *active* state at the same time.
- *Completed or Terminated*: An instance of the given service is considered to be completed for a particular customer (program) if all agreed terms and conditions are satisfied. Otherwise, if a problem occurs and it fails to complete by the given time it is considered to be terminated.

So states are associated with individual services as depicted by Figure 1

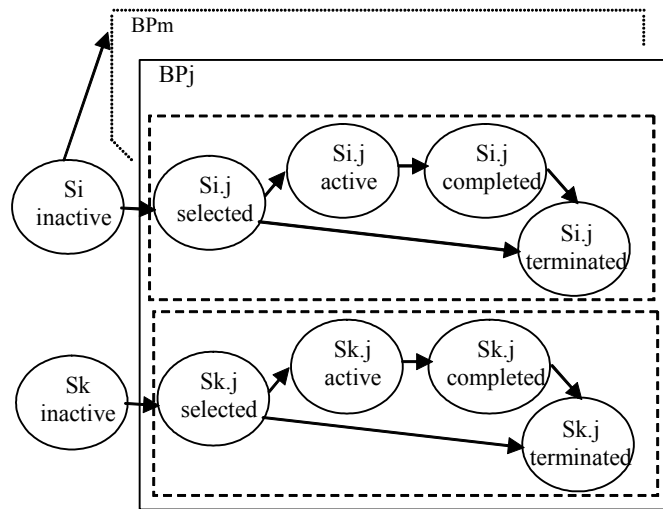


Figure 1: Different states of services S_i and S_k

Suppose that BP_j and BP_m are two instances of two different business processes that both contain service S_i . Notation $S_{i,j}$ is used to indicate instance of service S_i for business process BP_j . During service composition for BP_j , all its individual services are in the selected states. Then during process execution, $S_{i,j}$ could be in the active state (if it is currently executed) and $S_{k,j}$ could be still in the selected state. Obviously, the same web service S_i in the inactive state could have two corresponding instances each in different states for example $S_{i,j}$ in selected and $S_{i,m}$ in active state. Note that the arcs represent transitions between different states of the same service – not control flows.

Therefore, a declarative model of business process is a collection of services all in different states. Note that services could be further described by a number of tasks. Individual services are activated when their corresponding conditions are satisfied. Therefore, there are no control flows and that makes the declarative model much more flexible than control-flow oriented models.

The following Table 1 summarises the main differences between control-flow and declarative business process models.

Note that the declarative model of a business process is a conceptual model and as such independent from underlying technical implementation. However, implementation of this model at the technical implementation has be much more flexible than what is currently provided by workflow technology or web-services based on control-flow oriented standards.

Finally it is important to point out that, the declarative model is not meant to be used by end-users to describe their services or model business processes. This model has provided theoretical foundation necessary for the implementation of component-based workflow as illustrated in the following section.

Table 1: Control-flow versus declarative process models

Modeling paradigm (conceptual level)	Control-flow oriented	Declarative
Modeling components	procedural: tasks linked by control-flows	Business process is a collection of services; during process execution all selected services go through a number of different states based on their pre-conditions.
Model type	prescriptive	descriptive (event-driven)
Business process composition	Clearly distinguishable modeling (build) and execution (run) phases	Modeling and execution phases are intertwined
Coordination support	Predefined (based on control-flows)	Flexible (based on pre- and post-conditions; no control flows)
Modification during BP execution	Very limited	Flexible

5.2 Basic Functionality

A high-level architecture of the proposed process-oriented CRM is depicted by Figure 2. At the technical level this CRM is enabled by a component-based workflow system designed on the basis of the theoretical model introduced in the previous section.

The main objective of such system is to provide support for:

- customers to monitor their own individual programs
- advisors to integrate, coordinate and monitor the selected services included in a personalised program for each customer.
- service providers so they can easily describe their services and made them available so they could be included into the personalised programs
- management to collect data and analyse the performance of individual service providers as well as program advisors.

Graphical User Interfaces (GUIs) for all types of users are designed as simple to use, web-based interfaces. To describe their services, service providers fill out a web-based, pre defined form. This includes description of their services, availability, pre-conditions, temporal and deontic (normative) constraints as well as post conditions. When an individual lifestyle program is designed by an advisor and activated by a customer or program advisor, all services are automatically scheduled. Pre-conditions and post-conditions are then used to activate individual services as required by the program. Most importantly, a program can be easily changed if required by the customer or service provider.

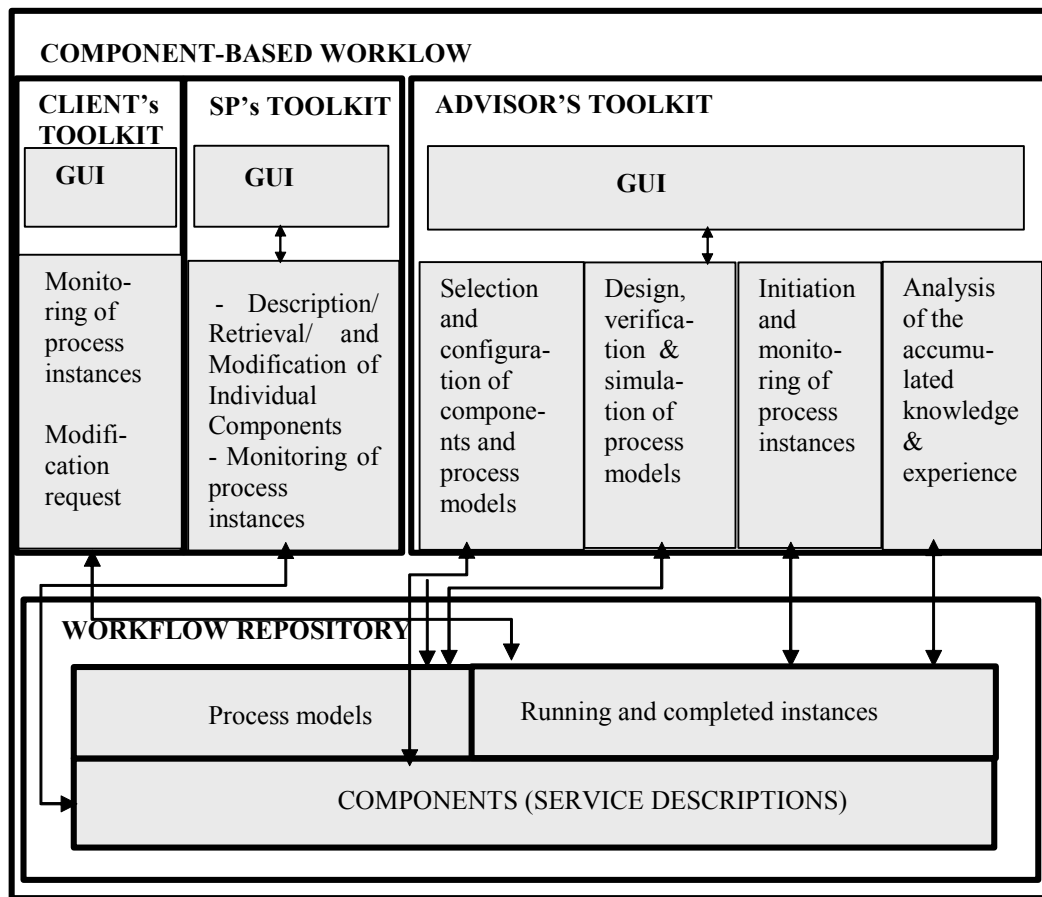


Figure 2: The enabling component-based workflow- a high level architecture

Furthermore, the solution also supports “organisational mobility” of service providers as they can work with more than one company and are not “locked-in” proprietary systems and solutions. This is a very important issue in this industry so the independent service providers remain independent.

At the time of writing of this paper, a pilot study has been completed to test underlying theoretical concepts and to further improve our understanding of the problem domain. The study also included development of a prototype of a process-based CRM based on the above-depicted architecture. The system has been designed as a generic system that can be easily transferred to any other SME that deals with a number of service providers.

Finally, in order to offer this type of CRM, the company needs to investigate different strategies that will encourage adoption of this technology among service providers. Obviously, the company as well as its customers can fully benefit from this type of process support only if all service providers become involved and adopt this technology.

6. Conclusion and Future Work

To remain competitive, service-oriented businesses are starting to offer an ever increasing number of different related services. Consequently, customers are often expected to deal with large number of service providers and to coordinate their services. This is not such a big issue in large, service oriented companies as they have the means and resources to

provide integrated systems. However, this type of customer support appears to be very important in service-oriented SMEs. The problem of service integration creates a need for different type of CRM support (Customer Relationship Management) not currently provided by the analytical, collaborative or operational CRM systems.

This paper proposes a new type of process-oriented CRM system suitable for SMEs that seek to integrate a large number of service providers and their respective services and create an added value for their customers. This technology is enabled by component-based workflow technology. Design of this system is based on a flexible model of declarative business process that is also briefly described in this paper. To illustrate the importance of the proposed type of CRM support, the paper uses an example from a service-oriented SME in Australia.

The current state of e-commerce adoption in health and fitness industry offers a unique opportunity to create new standards for service description as well as offer unique, standardised solutions that could be implemented by more than one organisation. Current and future work involve further identification of the research issues and problems related to this type of process-CRM as well as investigation of standardisation issues for service descriptions in this industry sector.

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