

SOA and BPM Partnership: A paradigm for Dynamic and Flexible Process and I.T. Management

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Abstract—Business Process Management (BPM) helps in optimizing the business processes inside an enterprise. But BPM architecture does not provide any help for extending the enterprise. Modern business environments and rapidly changing technologies are asking for brisk changes in the business processes. Service Oriented Architecture (SOA) can help in enabling the success of enterprise-wide BPM. SOA supports agility in software development that is directly related to achieve loose coupling of interacting software agents. Agility is a premium concern of the current software designing architectures. Together, BPM and SOA provide a perfect combination for enterprise computing. SOA provides the capabilities for services to be combined together and to support and create an agile, flexible enterprise. But there are still many questions to answer; BPM is better or SOA? and what is the future track of BPM and SOA? This paper tries to answer some of these important questions.

Keywords—Information Systems, BPM, SOA, Process management, IT management.

I. INTRODUCTION

IN last few decades, the information technology (IT) has been a significant counterpart of the business enterprises. Many changes have been evolved in the style and structure of the business oriented application development. Where the IT environments require the dynamic digestion of the changing needs and requirements, the business processes also require suitable optimizations and appropriate adaptations. Service Oriented Architecture (SOA) has evolved as a major solution to reduce cohesiveness among software modules of an information system and increasing responsiveness to the changing business requirements [1]. SOA helps in developing

and managing flexible information system applications as well as to integrate the complex and assorted IT technologies. On the other hand for improved and effective process management, and adaptation in an enterprise, Business Process Management (BPM) has evolved as premium solution. BPM allows a business enterprise to computerize, optimize and implement underlying activities with the help of adaptable business processes. Major participants involved in a simple BPM based system are vendors, IT infrastructure, vendors, database, customers, etc. The following figure shows the basic concepts of BPM [5].

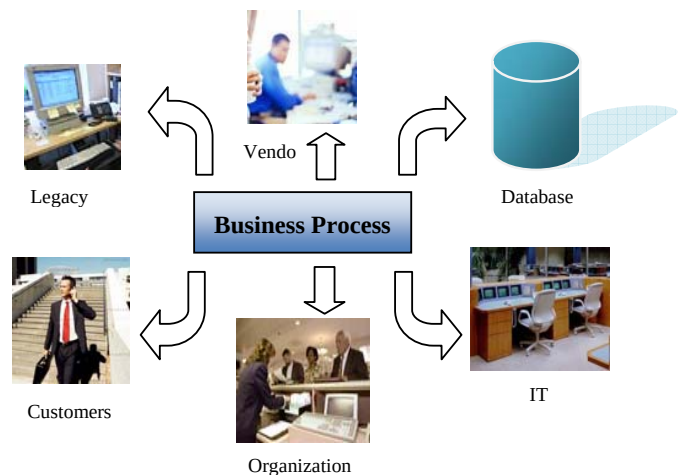


Fig. 1 Basic components of BPM

Typically, SOA and BPM are two divergent disciplines. BPM is a business driven activity that corresponds to manage the processes in a business enterprise. In a conventional BPM life-cycle, there are three major phases: process modeling, process implementation and process optimization [2]. In the process modeling phase, a business process is modeled for computerized simulation. In the process implementation phase, processes are typically implemented and deployed in the enterprise. In the process optimization phase, processes are monitored and optimized for better efficiency and affectivity. On the other side, SOA is an IT driven activity that facilitates the communication of loosely coupled and vastly interoperable services [5]. These services are generally independent from the underlying platform and the

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development technologies (e.g. Java and .NET). Due to the diminution in cohesiveness among software modules, these modules are easy to reuse as they are independent of the platform as well. SOA mainly manages the operational resources and also helps in bridging the business processes. Besides the by-definition differences in BPM and SOA, there are some other operational variances. SOA is a bottom-up architectural approach while BPM is top-down process approach [3].

It is obvious that SOA and BPM are two independent and dissimilar measures. If only SOA is implemented without BPM in an enterprise, reusable and reliable services can be created, but this framework will not be agile further [4]. The services will not have ability of continuous improvement and optimize themselves. As by nature BPM is un-scaleable and un-adaptive in nature [11]. As a consequence, the feature of monitoring the services and optimize them will be diminished straightway. Similarly, if a framework that is based on only BPM and lacks the characteristics of SOA, can be used to build business applications for a business enterprise but these applications will be so cohesive that the enterprise will not be enough flexible to further extend. Analysis by many organizations has proved the partnership of BPM and SOA has evolved as formidable solution for the modern business needs.

In this article, next session describes the similarities if SOA and BPM and these similarities help to design a convergence in BPM and SOA. Later on the relationship of SOA and BPM has defined and also the importance of BPM and SOA is justified. At the end, a proposed architecture is also presented and some implementation constraints are also discussed.

II. LITERATURE REVIEW

The BPM-SOA combination allows services to be used as reusable components that can be orchestrated to support the needs of dynamic business processes [3]. The combination enables businesses to iteratively design and optimize business processes that are based on services that can be changed quickly, instead of being 'hard-wired'. A critical success factor of SOA-BPM is the adoption of industry recognized technology standards [11], which allow the architecture to be portable and executable in almost any chosen hardware and software environment, eliminating the need to be tied to any specific vendor.

Using business process modeling (BPM) in concert with service-oriented architecture (SOA) – a perfectly aligned partnership of Business and IT investments – is the fast path to ensuring true business agility. BPM provides a wonderful abstraction for building business systems [16]. But all too often BPM is used to build higher level, more efficient, but nonetheless silo applications rather than contributing to an overall flexible, agile enterprise. This is where SOA comes in. SOA provides the application platform to bridges to the business processes and the operational resources [12].

Together BPM and SOA help facilitate the next phase of

business process evolution – going from merely automating repeatable processes to flexible automation of dynamic processes [17]. Together, BPM and SOA provide a perfect combination for enterprise computing. BPM provides the higher-level abstraction for defining businesses processes, as well as other important capabilities of monitoring and managing those processes [9].

III. SOA AND BPM SIMILARITIES

SOA and BPM are two different disciplines and they are used for their distinct applications. These disciplines have been implemented in the business enterprises and have been successfully used for their respective functions. According to different sources; SOA and BPM are different and they cannot work together and according to some other sources they are similar and can be embedded into a single solution.

Colleen Frye [4] says that “BPM is a small fish inside the belly of the SOA whale...” In the same article, Colleen says also that “BPM and SOA are two sides of the same coin; joined at the hip”. Mike Rosen [9] thinks that “BPM and SOA provide a perfect combination for enterprise computing”. Ismael Ghalimi [6] says that “BPM is SOA’s killer application and SOA is BPM’s enabling infrastructure.” According to Ismael, BPM cannot work together but there are many similarities in both SOA and BPM. Some basic similarities are as following.

A. Both Encourage Reuse

SOA and BPM both encourage reuse of the processes and the services. SOA supports agility which leads to loosely coupled modules in an information system application. These modules can be reused in various applications [11]. BPM allows for the management of a dynamic infrastructure by separating business logic and rules, data flows and business services. Similar to SOA, BPM also supports reusing of processes rules and services.

B. Both Accommodate Dynamic Changes

BPM and SOA both also accommodate dynamic changes. BPM has the ability to adapt the alterations in the processes. BPM has a regular process of monitoring the running process and making the required changes in the process [13]. Similar to BPM, SOA also support modification dynamically. Due to loosely coupled modules, it is easy to replace current modules. Thus dynamic changes can be tolerated in both SOA and BPM.

C. Both Observe Iterative Process

Both BPM and SOA are iterative processes. SOA is also an iterative process, in which the modules are made loosely coupled in an iterative way. Various steps are performed in iteration as SOA discovery for services identification; assessment phase for the evaluation of the services; planning and decision phase; execution phase for deployment; and continuous monitoring for the ultimate optimization that is the last phase of this life cycle.

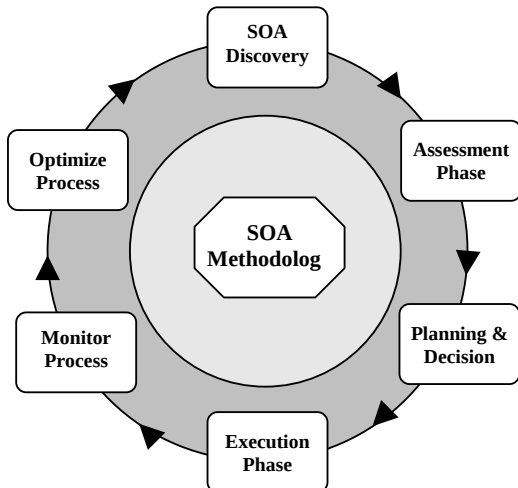


Fig. 2 SOA an interactive process

In BPM, there is a complete lifecycle in which first of all the processes are modeled and then they are implemented. After deploying the processes, these processes are continuously monitored and then appropriate amendments are made [7].

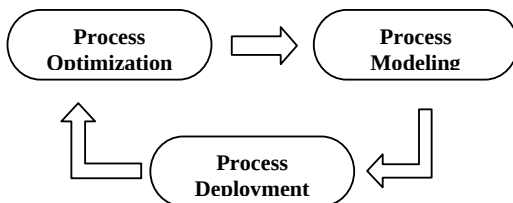


Fig. 3 BPM an interactive process

As in the following diagram it has been shown that the Business Process Management is an iterative process in which process modeling in process deploying and process optimizing carries on for continuous improvement.

D. Both Support Loose Coupling

BPM and SOA help in creating reusable services in a business enterprise. Services are reusable due to their loose coupling. SOA paradigm by definition supports agility which makes the modules less cohesive and less inter-dependent [5]. On the other side in BPM, processes are also defined and implemented as standalone service.

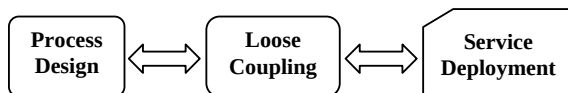


Fig. 4 BPM and SOA supporting loose coupling in processes and services

By nature, BPM also decreases cohesiveness among the related process in a domain to make them less unified and inter-related.

E. Both Deal with Distributive Environment

SOA and BPM both support internal and external applications in a distributed technology platform for a distributed environment in an organization. In a distributive environment, a distributed mechanism is required that disperses the information among various sites in a business enterprise with ease and affectivity [14]. Factors like reusability and loose coupling are required to build a robust distributed environment.

IV. IMPORTANCE OF PARTNERSHIP

Both BPM and SOA in combination provide a perfect combination for enterprise computing. BPM provides the higher-level abstraction for defining businesses processes, as well as other important capabilities of monitoring and managing those processes [4]. Services provide the functions that support those processes. SOA provides the capabilities for services to be combined together and to support and create an agile, flexible enterprise [6]. Still, some interconnectivity and cohesiveness can be evolved if they put together.

Following are some reasons which show that BPM and SOA are needs for each other because both of them lack something without the other.

A. SOA without BPM

If SOA is employed without BPM in a large sized business organization, SOA will support the creation of the reusable and reliable services for appropriate orchestration [9]. These services are agile and reusable. An Agile Application is a loosely coupled set of services and it is easily modified to address changing business needs and it is scalable by design [8]. But without BPM, Service will not have ability of continuous improvement and optimize themselves. As by nature BPM is un-scaleable and un-adaptive in nature [11]. Hence these characteristics can be injected in business enterprise architecture by SOA.

B. BPM without SOA

On the other hand, if BPM is employed without SOA in a business enterprise, application can be built in an organization but that business organization will not be able to extend. BPM does not require SOA as it can work alone but SOA simplifies BPM implementation in a business organization. SOA provides a layer of control and governance for IT underneath BPM.

BPM can be executed with or without SOA [9]. BPM is a strategy for managing and optimizing the performance of the business through continuous optimization of business processes in a closed loop cycle of modeling, execution and measurement. But SOA can play a critical role in enabling the success of BPM. SOA enables IT to clearly define and govern how business processes interact with underlying systems and ensure that the BPM implementation focuses on the business processes, not on technical integration requirements [10]. SOA can also help in a business organization to achieve proper reuse, governance and provide loose coupling among

application modules, especially when considering enterprise-wide BPM.

C. SOA-BPM Relationship

The integration technology must loosely couple the applications and resources that make up the process, otherwise the logic of a process will get hard-coded into a particular technology platform [9], which may be expensive to change and therefore defeat the entire purpose of BPM. This is where standards-based service oriented architecture (SOA) comes in. An SOA provides the technical ability to create that process independence. SOA standards, such as Web Services, make information resources and task automation applications available yet loosely integrated for process designers to use and reuse [15]. Thus processes modeled with BPM tools can be rapidly implemented in production via SOA infrastructure.

As shown in the Fig. 5, BPM is dynamic process for the automated process optimization and adaptation. Its other counterpart SOA is a vibrant mechanism for making the services agile and it provides orchestration among them.

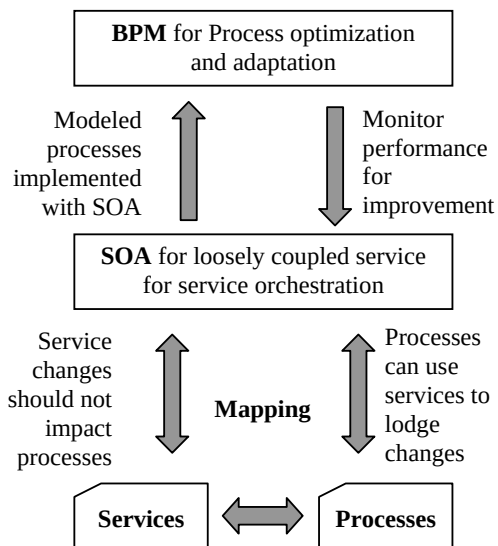


Fig. 5 Relationship in BPM and SOA

SOA and BPM have adequate similarities that are required to build their composite architecture. For this purpose, the processes are implemented as services and in other words processes are mapped to the services [17]. New and changed processes modeled in the BPM solution may be implemented in the enterprise infrastructure more rapidly because the SOA solution decouples the designed process from the specific implementation of particular applications that communicate only through a specific integration solution.

V. PROPOSED ARCHITECTURE

The BPM-SOA combination leads to the improved alignment of Business and IT domains alignment that provides improvement, efficiency and fast way of developing IT based

business enterprises. Modernized business requirements needs building of “services” that can be reused throughout the complex enterprise in a variety of ways to make the things simple and efficient. Furthermore, these services should be accessible by the employees, partners, and suppliers via the web [10]. This is not an easy task but it is an essential one for the agile enterprise. It requires the combined strengths of BPM and SOA.

The BPM-SOA partnership is being used by agile organizations to drive ever greater levels of performance [17]. Keen competitors should absolutely be putting this dynamic-duo to work in their operation. For those still looking into their options, a bit more insight into how BPM and SOA work together may be useful. Many organizations as Oracle [12], CGI [11], BEA [8], BPT [5], etc have proposed their possible architectures. Following is the brief illustration of these proposed architectures of BPM and SOA.

In this architecture the BPM has been transplanted in the orthodox architecture of SOA. In bottom 3 layers are typical layers of SOA. A brief description of these layers has been given below.

A. Legacy Applications Layer

In the SOA layers, legacy and custom applications are at the bottom. This layer consists of the information server, legacy mainframe, storage media of all types and also the underlying databases. Generally, all operational resources are related to this bottom layer. All legacy and logic components are implemented at this layer. At operational resource level, SOA exposes the existing capabilities as integration services.

B. Services Implementation Layer

After legacy and custom applications layer, there come the services implementation layers. These services are independent of the underlying platform that consists of database, the programming languages and operating system. As, SOA is the combination of technologies that are required to enable the migration of inflexible IT functions into merged, loosely coupled and on-demand services.

C. Services Assembly Layer

In the third layer, service assembly has been provided for the sake of service agility. In service assembly, basically, the features like automated arrangement, coordination and management are provided among the complex automated systems, middle-ware and services. These features also result in reusable software components that also support agility in the underlying information system.

D. Services Wrapper Layer

This layer provides the customization of all the services as per business rules. Services provided by the lower layers are customized to fulfill the requirements and needs of the business processes defined in the upper layers.

E. Business Services Layer

After the three conventional SOA layers, there comes the

base layer of BPM that is basically the business services layer. In this layer the services are exposed to be used by various processes. These business services provide new services interfaces based on enterprise semantic and functional requirements and also help to map them according to the existing system.

F. Business Process Workflows Layer

Next layer is of the business processes and work-flows. Business processes use their required service for their implementation and these processes are independent of the underlying services.

Following is the proposed combined architecture of BPM and SOA.

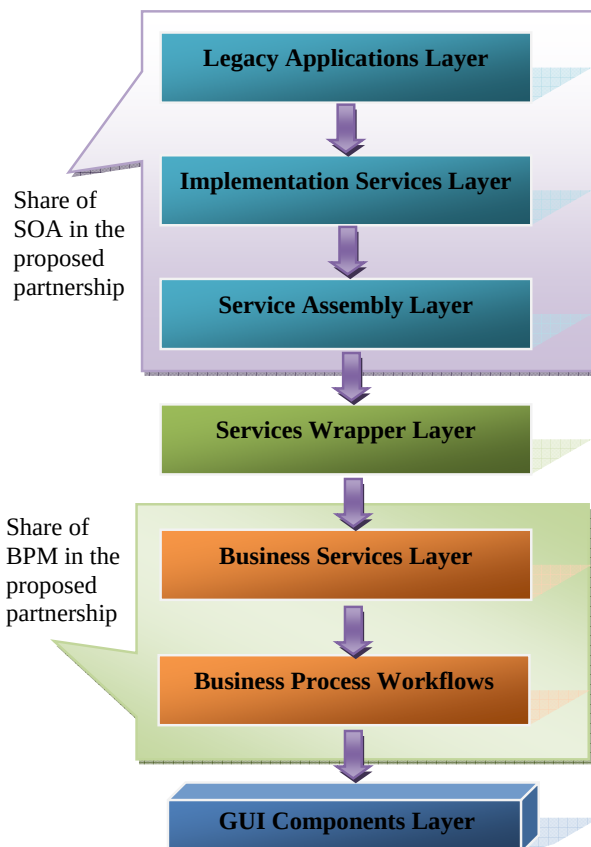


Fig. 6 Relationship in BPM and SOA

G. GUI Components Layer

At the top, there is the layer of GUI components and front end applications that implicitly use the underlying services and processes implemented by both BPM and SOA. Oracle has provided a complete "Oracle BPA Suit" for this type of implementation.

VI. IMPLEMENTATION DETAILS

BPM and SOA have different implementation approaches. BPM is top-down process approach and SOA is bottom-up architectural approach. But if they are deployed together,

processes modeled by BPM tools can be implemented by SOA more efficiently. In an organization, when a BPM is deployed in an organization for automated process modeling, implementation and optimization [16].

BPM Deployed in a Business Enterprise

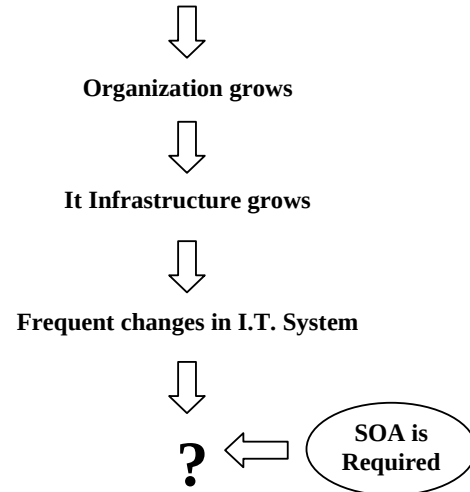


Fig. 7 BPM and SOA relationship

This agility is the facto that is missing in BPM. SOA is required for this purpose. This process has been shown in the above diagram.

Due to increase in business volume of an organization, the organization grows gradually and steadily. With the expansion of the size of the business organization, I.T. infrastructure in the organization also expands. In the result of this expansion, I.T. system becomes more complex and composite. With the passage of time, the frequent changes in I.T. services are required. Together BPM and SOA facilitate the next phase of business process evolution from merely "automated" to "managed flexibility." Thus business automation will no longer be about hard-coding a function to be repeated infinitely [10]. Automation will be about creating services reusable in many different ways in multiple processes that can be continuously improved. This helps allow enterprises to achieve dramatic improvements in market capture, cost effectiveness and profitability.

A. Soft Coding of Processes

In a combined atmosphere of SOA and BOM, processes and services need to work together and also support each other. But the processes are required to be independent of the underlying services to provide flexibility and competitiveness [12]. For this purpose, a middle interface layer is required that may keep processes and services apart and also provide requisite communication between them. This separation of process and implementation layers prevents hard-coding of the processes into a technology platform resulting in the greater flexibility.

B. Services and Processes Composition

For the partnership of BPM with SOA the major goal is composition of processes and the services. We need to compose the meaningful business processes and underplaying services in the business organization. The different services that need to be composed into the enterprise processes are designed by different and independent organizations [16]. Due to this reason, SOA has to provide enough context and structure to make these different services work together.

C. Runtime Process Management

Run-time process management is another integral issue of SOA and BPM partnership. If SOA is not used in BPM deployment in a business organizations processes will not have run-time management facility. The run-time process management tools in BPM and SOA partnership can capture the actual state of the running system [12]. In a business organization, such tools will allow a change in the running process, to be automatically reflected on the application and composition and vise-versa.

D. Adaptation of Standards

For the successful partnership among SOA and BPM, a robust solution is required that will base on a set of protocols and tools. Industry standards should be adapted for these protocols and tools as they are not all compatible among each others. For a successful solution, the architecture should be allowed to be transportable and operational independently from specific vendors or technologies [17]. These technologies include used hardware, operating system, and software environments, etc. The smooth integration of the compatible tools and real-time business processes is required as well for successful partnership of BPM and SOA.

E. Terminology Mapping

BPM and SOA are different platforms as BPM is a process driven platform and on the other side, SOA is a service driven platform. It is a basic requirement that to converge two different plate forms, a unified approach is required to associate two methodologies together. There is also a gap between the two viewpoints when it comes to using the same terminology to mean different things [15]. For instance, the same terms like business processes, businesses services, business practices, business components and business capabilities are often used to mean different things to the two camps. With the growing trend to adopt a unified BPM-SOA modeling and architectural approach, there will be more pressures to unify and 'standardize' the technical terms to help create a unified mindset.

VII. BENEFITS OF BPM AND SOA PARTNERSHIP

BPM and SOA are the counterparts in the modern business and information system's requirements. There can be many benefits of using the BPM and SOA in combination. SOA minimizes the effects of changes on the environments that cause many requisite benefits. Following are some advantages

that can be attained by implementing both SOA and BPM in combination in a business enterprise:

- The combination of BPM and SOA can reduce the cost of a business enterprise: operating cost, development and maintenance cost.
- Their combination can be helpful in speeding up the course of process creation and modification.
- Their partnership can also be used to increase the overall efficiency of a particular business enterprise.
- Complexity if the process model is decreased by enhancing the reusability factor.
- The cooperation of BPM and SOA supports to an enterprise at a time is agile, flexible to expand and can adapt the dynamic changes.

VIII. CONCLUSION

Together BPM and SOA help facilitate the next phase of business process evolution – going from merely automating repeatable processes to flexible automation of dynamic processes. This evolution is occurring because enterprises must compete more effectively by adapting to market changes faster, improving efficiency continuously and streamlining collaboration across traditionally siloed departments. BPM is a strategy for managing and optimizing the performance of the business through continuous optimization of business processes in a closed loop cycle of modeling, execution and measurement. But SOA can play a critical role in enabling the success of BPM. Modern BPM solutions, such as IBM WebSphere Business Modeler and Business Monitor, have helped to dramatically simplify the modeling, monitoring and redesign of extremely complex processes containing automated functions and personnel decision making. These BPM solutions make process models living representations of how organizations operate to deliver value and how organizational operations can change to help increase that value.

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REFERENCES

- [1] Aalast der Van, W.M.P., ter Hofstede, A.H.M. and Weske, M.: "Business Process Management: A Survey", in Business Process Management, Proceedings of the First International Conference. Springer Verlag, 2003.
- [2] Heather Ashton and David Kelly: "The Business Impact of BPM with SOA: Building a Business Case for BPM with SOA ROI", Upside Research, Inc. www.upsideresearch.com, January 2006.
- [3] Faouzi Kamoun, (2007) "A Roadmap towards the Convergence of Business Process Management and Service Oriented Architecture",
- [4] F. Colleen, "Special Report: BPM Inside the Belly of the SOA Whale", Web Services News, June 15, 2006, pp. 1-4.
- [5] Faisal Bhombal., "SOA and BPM: Service Oriented Architecture and business process management – PRIMAC Systems road map for 2007" – PRIMAC Systems Inc. fbhombal@vercom.com
- [6] Ismael Ghalimi, (2006) "BPM is SOA's Killer Application" An IT Redux article, August 13, 2006. <http://itredux.com/blog/2006/08/13/bpm-is-soas-killer-application/>
- [7] S. Bruce, "BPM on SOA: What would it look like? – Part 1 ", Bruce Silver Associates Article, August 21, 2006.
- [8] Martin Percival, "BPM and SOA: Putting SOA to work with BPM", EMEA Product Director, BEA, www.eudownload.bea.com/uk/events/bpm/Edinburgh/BPM-and-SOA.pdf
- [9] Mike Rosen: "BPM and SOA: Where does one end and other starts", A BPT Column, January 2006.
- [10] TIBCO, "Business Process Management on an SOA Foundation: A Unified Framework for Process Design and Deployment, www.tibco.com/software/soa/.
- [11] Michael Madsen, "Unlocking the Power of SOA with Business Process" Modeling, 2006 by CGI Group Inc.
- [12] Phil McGlauchlin, Fusion Specialist, "ORACLE-Business Process Analysis Suit: Overview & Statement of Direction", www.oracle.com
- [13] Jesper Joergensen, "BPM and SOA: Even better together", IT2IT Insight, The program of IT Professionals, by IT Professionals, director BEA <http://www.bea.com/newsletters/it2it/06aug/bpmsoa.jsp>
- [14] Jan Baan, Theodoor Van Donge, Nary Singh" Convergence of BPMS and SOA: Making Beautiful Music Together", CORDYS Report, April 2007, cordys.com/cordyscms_com/letter_jan_baan_april_2007.php
- [15] V. Ken, P. Henry, "The Forrester Wave: Integration-Centric Business Process Management Suites", Forrester Research Inc. Report, Q4, 2006, pp. 1-16.
- [16] Jack Hilty, "Build the Most Competitive Enterprise: Leverage the powerful Partnership of BPM and SOA", SentientPoint, Inc.,
- [17] N. Jasmine, "BPM and SOA: Better Together", IBM White Paper, 2005, pp. 1-12.