Ownership relevance in aspect-oriented business process models
Julio Cesar Sampaio do Prado Leite, Flavia Maria Santoro, Claudia Cappelli, Thais Vasconcelos Batista, Fabiana Jack Nogueira Santos,

Article information:
To cite this document:
Permanent link to this document:
https://doi.org/10.1108/BPMJ-01-2015-0006

Downloaded on: 09 February 2018, At: 09:56 (PT)
References: this document contains references to 33 other documents.
To copy this document: permissions@emeraldinsight.com
The fulltext of this document has been downloaded 375 times since 2016*

Users who downloaded this article also downloaded:

Access to this document was granted through an Emerald subscription provided by emerald-srm:418888 []

For Authors
If you would like to write for this, or any other Emerald publication, then please use our Emerald for Authors service information about how to choose which publication to write for and submission guidelines are available for all. Please visit www.emeraldinsight.com/authors for more information.

About Emerald www.emeraldinsight.com
Emerald is a global publisher linking research and practice to the benefit of society. The company manages a portfolio of more than 290 journals and over 2,350 books and book series volumes, as well as providing an extensive range of online products and additional customer resources and services.
Emerald is both COUNTER 4 and TRANSFER compliant. The organization is a partner of the Committee on Publication Ethics (COPE) and also works with Portico and the LOCKSS initiative for digital archive preservation.

*Related content and download information correct at time of download.
Ownership relevance in aspect-oriented business process models

Julio Cesar Sampaio do Prado Leite
Departamento de Informática, PUC-Rio, Rio de Janeiro, Brazil
Flavia Maria Santoro and Claudia Cappelli
Departamento de Informática Aplicada,
Universidade Federal do Estado do Rio de Janeiro, Rio de Janeiro, Brazil
Thais Vasconcelos Batista
Departamento de Ciências da Computação,
Universidade Federal do Rio Grande do Norte, Natal, Brazil, and
Fabiana Jack Nogueira Santos
Departamento de Informática Aplicada,
Universidade Federal do Estado do Rio de Janeiro, Rio de Janeiro, Brazil

Abstract
Purpose – The purpose of this paper is to propose a representation scheme based on the i* strategic actor model to represent the process owner information and show how to incorporate this approach into the event driven process chain and Business Process Modeling Notation-BPMN meta-models and also into the aspect-oriented business process modeling (BPM) context.
Design/methodology/approach – The authors use a case study in a real setting to evaluate the proposal and a controlled experiment to get more evidence about its relevance.
Findings – The authors presented evidence both from a case study in a real-world library showing the importance of representing previously unavailable – process owner information, and from an experiment which involved participants analyzing the same models of the case study, confirming the preliminary evidences. It is important to stress the recognition that the proposed representation provided more transparency, in terms of ownership, than the usual BPM models. These benefits are due to the combination of the aspect-oriented approach and the strategic actor model, providing ownership information in a more transparent way.
Originality/value – The authors not only argue the importance of clearly established process ownership, both of the core process and the aspectual process, but also the authors presented an approach to represent the actor involved in process and aspect ownership as an instantiation of the i* strategic actor. Using this approach, the process owner can be defined in terms of actors instead of the activities performed. It is also possible to define the aspect owner and to include the aspectual process concept in the business process model.
Keywords Process design, Business process management, Process modelling, Process owner, Aspect owner, Business process models, Crosscutting concerns, Strategic actor
Paper type Research paper

1. Introduction
Business process modeling (BPM) is a key activity for a modern organization, which may choose from several business process modeling languages (BPMLs) available. Most of these BPM languages provide a way to represent the role or organizational unit responsible for executing process’ tasks. However, the languages for Business Process Management neglect the importance of representing process ownership.

Process ownership is distinct from process competence. Competence refers to the ability of carrying on a given process. A pool or a lane in a BPM language represents
competence of a process, which are named by terms referring either to an organization or to an organizational position or role. In some cases, an individual actor may be named in a lane as the person executing the process. On the other hand, ownership is a more complex concept.

In fact, existing work on Business Process Management (Hammer and Stanton, 1999, 2007; Jeston and Nelis, 2006; Hengst et al., 2004; Kohlbacher, 2009; Larsen and Klischewski, 2004) has stressed the key role of the process owner as someone responsible for the end-to-end process. The process owner’s attributions include process design and operation (ensuring it is appropriately performed). In order to run a process, a process owner has to obtain resources, establish and implement tools to facilitate process execution, ensure high performance, and interfere to improve the process whenever needed.

In this paper it is argued that process ownership information should be considered in the context of business processes models and a representation scheme is proposed to express that information. The general requirements for this representation are as follows: it must be able to describe ownership; be able to differentiate between design time and operation time; be able to provide integration with existing BPM models; and consider that processes can be crosscutting to other processes.

We performed a literature survey on the topic of process ownership, and found out that the lack of information on process ownership poses a problem for organizations managing processes. We have also found out that most process languages, that is Business Process Management Notations (BPMN) fails to provide operators (representation entities) allowing for process ownership description.

This paper tackles this problem by proposing a new language/notation to allow for the representation of process ownership information. This language departs from the basic BPM languages and adds new representation entities. We exemplify the use of these new languages, which uses BPMN like notation. Based on the partial modeling of one real process we evaluated how the language presented the desired representativeness.

2. The quest for process ownership
The process owner is an important component of any business process management initiative, mainly those ones related to very well-structured processes aimed at monitoring performance. Hammer and Stanton (1999) states that the most visible difference between a process enterprise and a traditional organization is the existence of process owners. He argues that process ownership has to be a permanent role, for two reasons. First, process designs need to evolve as business conditions change, and process owners need to drive that evolution. Second, in the absence of strong process owners, the former organizational structures will soon reassert themselves. The advent of process owners is a dramatic change for most organizations, because it separates control over work from management of the people who perform the work. Hammer (2007) has also identified two groups of characteristics that indicate how well business processes are able to perform and sustain the performance. One group applies to individual processes and the other to the whole enterprise.

The first group is termed process enablers; these determine how well the process is able to function over time. This group comprises the following: the comprehensiveness of the process’s design, the ability of the people who perform the process; the appointment of a top-level process owner to supervise the process’s implementation and performance; the match between the process’s needs and the organization’s information and management systems; and the quality of the metrics used to evaluate
the process's performance. The second group, enterprise-wide capabilities, focuses on enterprise capabilities: leadership, culture, expertise, and governance.

The enterprise able to put the elements of the first group in place will have the capabilities of the second group. The two groups are highly dependent on each other. They are part of a framework termed Process and Enterprise Maturity Model (PEMM) (Hammer, 2007), which helps companies plan and evaluate their process-based transformations before executing them. In this framework, each enabler is at some level of development. The enterprise can be considered to be at a given level only if all enablers are at that same level, as such the dependence between the enablers is mutual. The relationship between the groups and process performance is such that, if organizational capabilities are stronger, there will be stronger enablers and, as a result, better process performance.

We consider the process owner important as an enabler for evaluating the success of process transformation, as proposed in PEMM (Hammer, 2007). According to Hammer (2007), the process owner is a senior executive responsible for the management of the process and its results. At strength level 1, this enabler's activities are identifying and documenting the process, communicating it to all performers, and sponsoring small-scale change in projects. At level 2, the process owner articulates the process's performance goals and a vision for its future, sponsors support redesign and improvement efforts, plans their implementation, and ensures they are in compliance with the design. At level 3, the process owner works with other process owners to integrate processes so as to achieve organizational goals. At the highest level 4, the process owner develops a strategic plan for the process, participates in organization strategic planning and collaborates with his partners, customers, and suppliers to sponsor inter-enterprise process redesign.

Jeston and Nelis (2006) mention three pillars of Business Process Management: processes, people, and technology. Processes are the activities performed by the organization and they are associated with objectives and goals. People are considered the key to process implementation. Technology is the tool supporting processes and people. People are key to change management stages during business process adoption. Hengst et al. (2004) list three types of stakeholder usually involved in change management initiatives: problem owners, decision makers, and analysts or consultants. Each belongs to one organizational level.

According to Jeston and Nelis (2006) there are two categories of management in Business Process Management: first, management of business processes integrated with organizational management; and second, management of process improvement. In the first category, business process managers, owners, or administrators have responsibilities, such as specifying goals and metrics associated with established objectives, communicating the objectives, goals, and initiatives to executors, monitoring, and managing progress toward objectives, motivating the group to surpass objectives and solve process disturbances, and encouraging the group to identify process improvements. One arrangement for putting this kind of management into practice is the division between senior and middle managers, the former responsible for the end-to-end process and the latter, for sub-processes or individual processes that are part of the end-to-end process.

Kohlbacher (2009) states that, associated with a business process, there must be a manager with end-to-end responsibilities. He presents a study of 44 Austrian metal and machinery industry organizations, 20.45 percent of which confirm that a process-oriented organizational approach yields clear responsibilities, because of the
process owner role, reducing uncertainties caused by departmental fragmentation of responsibilities.

In sub-process or individual process management, Jeston and Nelis (2006) propose classifying line managers by the scope of their activities. Operational managers work with clearly defined processes and their goals, adjusting human resourcing and solving operational issues. Tactical managers focus on possible process improvement, while strategic managers concern themselves with the business model and associated processes.

The second category, process improvement management, is responsible for identifying, developing, and deploying the benefits of process management. These managers’ responsibilities relate to supporting organizational and business managers in improving their processes, with focus on supporting modifications to reach long-term objectives. This group includes: first, the business process management project manager; second, the business process management program manager; third, the manager of the business process excellence office; and fourth, the chief process officer.

Managers in the first category are concerned with short-term goals and, in the second category, with improving processes in view of long-term goals. Some tension is caused between the groups, because any process modification may harm managers’ ability to reach their goals (Jeston and Nelis, 2006).

The main activities of the process owner, according to Jeston and Nelis (2006), are: to document the process and to ensure that documentation complies with the established standards and requirements; and to improve the process. The process owner is responsible for decisions, managing change, and implementing improvements; managing the process interfaces and boundaries; automating the process; managing process performance; and promoting the process approach.

Jeston and Nelis (2006) regard clear and appropriate attribution of process responsibilities and accountability as a challenge in Business Process Management. They argue that an organization can choose either to make functional managers responsible for their part of the process, to make functional managers responsible for the end-to-end process, or to make non-functional managers responsible for the end-to-end process. Each approach holds risks: in functional ownership of sub-processes, owners may see only their own process and make it difficult to implement end-to-end improvements that can damage their part. Also important is the respect for the process owner in the organization.

Larsen and Klischewski (2004) confirm that most business process approaches consider responsibility for, and design of, a process as centralized in only one person, the process owner, who has sufficient power to organize and direct the way other actors participate in and/or accept process reengineering and IT support. The process owner must be responsible for the end-to-end process and must be recognized by the organization as a leader. He needs authority and personal influence to ensure that those involved make the necessary changes. In order to keep the process owner permanently motivated, his performance must be directly related to the performance of the process.

Table I presents a summary of the foregoing definitions of process owner according to its responsibilities and activities. Because each author has a different objective, comparisons are difficult, but the process owner’s activities and characteristics can be clearly understood. Although in Hammer (2007), Hengst et al. (2004) and Larsen and Klischewski (2004), there is no distinction between design and execution level, we propose a view on this classification (third column of Table I). Inclusion of that information here reflects our experience with software development processes, where the design, implementation and maintenance phases are distinguished. To the best of our knowledge this contribution is not found elsewhere in the literature.
<table>
<thead>
<tr>
<th>Author</th>
<th>Division</th>
<th>Process owner activities</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hammer (2007)</td>
<td>Level 1</td>
<td>Identify and document the process</td>
<td>Design</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Communicate the process to all performers</td>
<td>Execution</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sponsor small-scale change projects</td>
<td>Execution</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Articulate process performance goals and a vision for its future</td>
<td>Design</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sponsor redesign and improvement efforts, plan their implementation and ensure compliance with design</td>
<td>Execution</td>
</tr>
<tr>
<td></td>
<td>Level 2</td>
<td>Work with other process owners to integrate processes to achieve organizational goals</td>
<td>Execution</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Develop a strategic plan for the process</td>
<td>Design</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Participate in organizational strategic planning</td>
<td>Design</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Collaborate with partners, customers and suppliers to sponsor inter-enterprise process redesign</td>
<td>Design</td>
</tr>
<tr>
<td>Jeston and Nelis (2006)</td>
<td></td>
<td>Specify goals and metrics associated with the objectives</td>
<td>Design</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Communicate objectives, goals, and initiatives to people executing</td>
<td>Execution</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Monitor and manage progress toward objectives</td>
<td>Execution</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Motivate the group to surpass objectives</td>
<td>Execution</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Solve process disturbances</td>
<td>Execution</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Encourage the group in identifying process improvements</td>
<td>Execution</td>
</tr>
<tr>
<td>Main activities</td>
<td></td>
<td>Identify, develop, and introduce benefits from process management</td>
<td>Design</td>
</tr>
<tr>
<td></td>
<td>Management of the processes improvement – long term</td>
<td>Document the process and warrant that it complies with established standards and requirements</td>
<td>Execution</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Improve the process, be responsible for decisions, change management, and implementation of improvement</td>
<td>Execution</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Manage interface, limits and boundaries of the process</td>
<td>Execution</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Automate the process</td>
<td>Execution</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Manage process performance</td>
<td>Execution</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Promote the process approach</td>
<td>Execution</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Design the process and become responsible for it</td>
<td>Design</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Organize and direct the way other actors participate in and accept reengineering and IT support</td>
<td>Execution</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Responsible for the end-to-end process</td>
<td>Execution</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Appointed by the leader of the organization; needs authority and personal influence</td>
<td>Execution</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Process owner’s performance must be directly related to process performance to keep him motivated</td>
<td>Execution</td>
</tr>
</tbody>
</table>

**Table I.** Summary of process owner activities classified by design and execution level
In summary, the process owner’s attributions include designing and operating the process (ensuring that it operates properly). In order to make a process operational, a process owner has to obtain resources, establish and implement tools to facilitate the process execution, ensure high performance, and interfere to improve the process whenever needed. Another conclusion is, for end-to-end processes, the importance of establishing a process owner with the necessary authority. While these conclusions provide the conceptual basis for our research, it makes clear that the relationship among the diverse owners of interrelated processes should be highlighted. We start describing the proposal for the use of aspect-oriented approach in BPM, followed by a proposal to explicitly model process ownership.

3. A notation (language) to represent process ownership

Our literature review confirms the results of List and Korherr (2006) that no approach was found to represent business process ownership, as well as provide hints of the benefit to be able to represent process ownership.

This section provides an overall view of the proposed notation, using conceptual models to show the proposed notation structure. We first detail the concept of process owner and aspect owner, and then we show how these concepts could be integrated with event driven process chain (EPC) and BPMN.

3.1 Process and aspect owners

We thus propose to represent the process owner using the strategic actor (Yu, 1995) approach, because that model explicitly represents actors in the context of intentional modeling. We also include the concept of aspect owner in this representation, because it refers to a manager responsible for the crosscutting parts of the processes. The characteristics of the aspect process are different, because it crosscuts other processes. Identifying aspectual elements in a process model is not a trivial task. To support detection, Cappelli et al. (2010) suggested heuristics for aspect identification based on previous work on requirements engineering (Silva, 2006) and presented as follows: “(i) if the concept is repeated several times in different places, (ii) if the concept is used by different other concepts, (iii) if the concept reflects an integration of semantically distinct situations, (iv) if the concepts represents a decision situation from which different options may be taken, (v) if the concept’s absence does not interfere with the global goals of the whole, (vi) if the concept can be reused in other domains, and (vii) if the concept is very much independent of other concepts.”

In a business process model, the role or organizational unit responsible for executing tasks can be represented at the design level, but there is no way to represent the owner. Considering the ARIS Framework (Scheer, 2000) in an EPC, for example, the Aris tool provides an attribute to indicate the person responsible for the process, as depicted in Figure 1. There are also attributes to allow customizations and attributes to register process change management. Sub-processes also have an attribute for setting the owner, but no representation is provided of the relationship between owners involved in business process composition or a representation to clarify the scope of the owner’s responsibility. This issue becomes especially important when using the AO-BPM (Cappelli et al., 2010) approach. As stated in Section 2, in the models generated with core process separated from aspect process, there may be two kinds of ownership: by aspect owner and by process owner.

Another important distinction regards business process levels: the design and execution. During design, when the process is considered either before it exists...
(to be) or through reverse engineering (as is), there is no way to represent the process owner. The same holds for the execution level, when processes are performed on a day-to-day basis, even if not automated. In that light, it is important to be able to represent process and aspect owners, and to distinguish between design and execution levels.

With a view to understanding the concept of actors in the i* framework better, Leite et al. (2007) propose the model in Figure 2. The following clarifications apply to the entities: real agent is an instance of agent, representing the concept of a specific person or software or hardware; agent is an actor with concrete, physical form such as a human individual; role is an abstract characterization of the behavior of a social actor in some specific context (its characteristics are easily transferable to other social actors); position is an intermediation between role and agent, referring to the position an agent occupies in an organization (position also covers a role); actor is an active entity that carries out actions to achieve goals by exercising know-how (it is a super class of agent, position, and role).

To facilitate that understanding, we consider an agent with the role of interviewer and position of information engineer. This distinction helps map organizational sectors.

**Figure 1.** Process attributes in Aris – process level

**Figure 2.** Strategic actor diagram

Source: Leite et al. (2007)
when modeling the positions. In a well-structured organization these two categories may be equivalents, the position being exactly the role to be played. This differentiation affords the modeler flexibility to distinguish between the two situations, if applicable in the organization.

To meet requirements (a) and (d) from Section 1 (be able to describe ownership, consider that processes can be crosscutting to other processes), we propose an instantiation as in the strategic actor diagram in Figure 3. An ACTOR is a parent class that can be instantiated in PERSON (agent), OWNER (role) and MANAGER (position). OWNER can be further specified as PROCESSOWNER or ASPECTOWNER. We consider a PERSON as an agent, because this indicates the physical form of the ACTOR. OWNER is a specific role that can be covered by a position and characterizes the actor’s behavior in the context of ownership (also it can be transferred to other social actors). The POSITION of MANAGER indicates the intermediary nature of this class between agent and role.

Regarding requirement (a), the OWNER can be defined as an active entity that carries out actions to achieve goals by exercising know-how; it also characterizes the behavior of a social actor in a given context. The goal of the PROCESSOWNER is to make the process perform as expected, and his context is the process he is responsible for. Regarding requirement (d), the crosscutting nature of the ownership of the aspect process is represented by the ASPECTOWNER. His goal is to make the aspectual process perform as expected in the core process, and his context is the aspect he is responsible for.

Consider an organization with the organizational structure represented in Figure 4. One of the processes performed in this organization is “Close Monthly Production.”

![Figure 3. Strategic actor instantiation for the ownership case](image1)

![Figure 4. Organizational structure of production in a hypothetical organization](image2)
Figure 5 depicts both process and aspect owner in the aspect-oriented business process model of “Close Monthly Production.”

The aspect-oriented business process Close Monthly Production was adapted from the real case of an oil and gas organization where monthly production must be consolidated with the correct data. In this business process, we identified three crosscutting concerns: first, divide monthly production; second, prepare production pledge and production forecast; and third, correct problems found in data.

This organization’s management approach may consider the options:

1. assign process owner and aspect owner to the same position or role (design level) or the same real agent (execution level);
2. assign process owner to real agent or to a role or position, and aspect owner of the three crosscutting concerns to another real agent or to a role or position; and
3. assign process owner to real agent or to a role or position, and three aspect owners, one for each crosscutting concern, to real agents or roles or positions.

In the second case, a view of the ownership diagram for the aspect-oriented process Close Monthly Production as depicted in Figure 5 should be created for the organizational structure in Figure 4.

3.2 Introducing the notion of owner in EPC and BPMN

To meet requirements (b) and (c) (be able to differentiate between design time and operation time, be able to provide integration with existing BPM models), we chose to incorporate our elements from Figure 5 into the EPC meta-model (OMG, 2006). Figure 6 presents the ARIS EPC (Scheer, 2000) meta-model using meta-object facility and the OMG meta-metamodel adapted from OMG (2006). The elements with which we propose to extend the ARIS EPC meta-model to reflect process and aspect ownership are in gray. The execution level and design level entities are specializations of the EPC entity. Owner and consequently process owner and aspect owner are specializations of the organization role, and owner is responsible for an EPC (this relation was incorporated from Hengst et al., 2004). The organizational unit can be refined by organizational role (Kohlbacher, 2009) and also refined by a position as manager. Person, manager, and organizational role are all specializations of actor.

The same extension was performed in order to incorporate process and aspect ownership into the BPMN meta-model, as depicted in Figure 7. In this case the EPC is converted to the entity process, and organizational role to pool, which represents the participant in a process.
Figure 6. EPC meta-model extended with process and aspect owner. Reprinted with permission from OMG (2009).
Figure 7. BPMN meta-model extended with process and aspect owner.
In business process diagrams, actors responsible for an activity are positioned in pools. So “pools” can be considered as actors. Since the owner is also positioned in a pool in our proposal, we consider that it can also inherit from the pool. The models presented here allow assigning an actor as the owner of the process (both core and aspects) in different instances of the process (each instance is a process or an EPC extended as execution level or design level, according to the diagrams in Figures 6 and 7). Therefore, two different instances of a given process may have the same or different owners.

Based on the meta-models presented we have created the ownership diagram to describe the ownership information as well as the trace or relation with the processes, either base process or aspectual process. Figures 5 and 11 are examples of this diagram.

In the next sections, we present the evaluation of the proposal through, respectively, a preliminary case study and a controlled experiment.

4. Case study
A case study (Yin, 2009) was conducted to evaluate our proposal. This case study considered the context of previously modeled processes performed in a university library.

The case study comprised a single case (one single analysis unit), conducted at the Rio de Janeiro State Federal University (UNIRIO), more precisely at its central library. Our main research question was:

**RQ1.** How important is the representation of process and aspect ownership for the process stakeholders?

Accordingly, the case study was designed in such a way as to evaluate the proposal in context, in terms of the real needs and characteristics of the organization and its staff. Two phases were planned. First, we modeled the processes (with the support of the participants) based on the aspect-oriented approach including the representation of the process owners according to our proposal. Second, we interviewed the main process manager in order to get impressions about the model built and the relevance of the proposal. The data collected and used to answer that research question were basically the models built and the results from an interview with the main process manager. The models were analyzed in terms of feasibility of representing core and aspectual processes. The original models (Figures 8 and 9) were produced by a research group jointly with a team of the organization’s employees. The AO-BPM models and the ownership diagram were produced by the authors of this paper. Below we show the “Procure paper documents” process in AO-BPM (Figure 10), the related ownership diagram (Figure 11) and we also detail the internal representation of AO-BPM with the explicit pointcuts (Figure 12). The models were shown to the library manager, an expert, in order to evaluate our proposal of representing process and aspect ownership.

4.1 The case at hand
UNIRIO Library consists of a central library and four sector libraries. All of them act as informational support for teaching, research, extension education and administration, thus integrating the academic and administrative structures. The organizational structure comprises one director and 12 librarians distributed over five physical libraries. The 12 librarians are responsible for process execution. Governance is performed by the director.
Figure 8.
Procure digital documents
Figure 9. Procure paper documents

Aspect-oriented business process models
Figure 10.
Aspect-oriented procure paper documents
The library collection comprises over 200,000 items, including books, pamphlets, periodicals, theses, dissertations, monographs, sheet music, records, plays, theater programs, as well as databases, covering the biomedical, exact sciences, humanities and arts fields. The central library also holds a collection of rare and special books. The library collections are available for on-site consultation. The teaching collections are loaned solely to the academic community. Library material is also available for loan to the external community, however. Via the internet, using the CARIBBEAN system, anyone may search the catalog and locate documents available in the UNIRIO library. A recent initiative with a view to understanding better and improving librarian processes, modeled all of these processes. It involved all 12 librarians and the director. A total of 15 interviews were conducted, some with all the librarians together, others with two or three of them. In addition, two validation meetings were held. During this work it was observed that several parts of the process were repeated. One example can be seen in Figure 8 procure digital documents and Figure 9 procure paper documents, both of which are procurement processes. The former relates to documents in digital format and accordingly it diverges from the latter in some of its activities, such as activation. The process with paper documents includes stamping the item, while this no longer required with the digital ones.

Using heuristics (i), (v), and (vi) aspect-oriented models were created for the business process “Procure digital documents” depicted in Figure 8 and “Procure paper documents” depicted in Figure 9. Details of the heuristics used are shown in Table II. These heuristics applied to Figure 9 produced the AO-BPM process diagram of Figure 11, which factor out the aspects, presenting the core process (in the left of the diagram) with less activities, that are the core activities. It is also important to note that the aspects will be under the responsibility of different actors, making explicit responsibilities related to these aspects.
**Figure 12.** Explicit pointcuts, or links linking the advices (aspects) to the core process.
<table>
<thead>
<tr>
<th>Business process</th>
<th>Element</th>
<th>Heuristics</th>
<th>Why</th>
</tr>
</thead>
<tbody>
<tr>
<td>Procure digital documents</td>
<td>Prepare procurement list</td>
<td>i, vii</td>
<td>Repeated in both processes and with potential use in all kinds of procurement process</td>
</tr>
<tr>
<td></td>
<td>Form procurement process</td>
<td>i, vii</td>
<td>Repeated in both processes and with potential use in all kinds of procurement process</td>
</tr>
<tr>
<td></td>
<td>Monitor procurement process</td>
<td>i, vii</td>
<td>Repeated in both processes and with potential use in all kinds of procurement process</td>
</tr>
<tr>
<td></td>
<td>File procurement proof</td>
<td>i, v</td>
<td>Repeated in both processes and the absence of this element does not interfere in the global goal; it is a supporting element</td>
</tr>
<tr>
<td></td>
<td>Attest invoice</td>
<td>i, vii</td>
<td>Repeated in both processes and with potential use in all kinds of payment process</td>
</tr>
<tr>
<td></td>
<td>Forward invoice</td>
<td>i, vii</td>
<td>Repeated in both processes and with potential use in all kinds of payment process</td>
</tr>
<tr>
<td></td>
<td>Request supplier quote</td>
<td>i</td>
<td>Repeated in both processes</td>
</tr>
<tr>
<td></td>
<td>Check item’s importance</td>
<td>i</td>
<td>Repeated in both processes</td>
</tr>
<tr>
<td></td>
<td>Insert request</td>
<td>i, vii</td>
<td>Repeated in both processes and with potential use in all kinds of procurement process</td>
</tr>
<tr>
<td></td>
<td>Forward request to CDU</td>
<td>i</td>
<td>Repeated in both processes</td>
</tr>
<tr>
<td></td>
<td>Check funds available</td>
<td>i, vii</td>
<td>Repeated in both processes and with potential use in all kinds of procurement process</td>
</tr>
<tr>
<td>Procure paper documents</td>
<td>Prepare procurement list</td>
<td>i, vii</td>
<td>Repeated in both processes and with potential use in all kinds of procurement process</td>
</tr>
<tr>
<td></td>
<td>Form procurement process</td>
<td>i, vii</td>
<td>Repeated in both processes and with potential use in all kinds of procurement process</td>
</tr>
<tr>
<td></td>
<td>Monitor procurement process</td>
<td>i, vii</td>
<td>Repeated in both processes and with potential use in all kinds of procurement process</td>
</tr>
<tr>
<td></td>
<td>File procurement proof</td>
<td>i, v</td>
<td>Repeated in both processes and the absence of this element does not interfere in the global goal; it is a supporting element</td>
</tr>
<tr>
<td></td>
<td>Attest invoice</td>
<td>i, vii</td>
<td>Repeated in both processes and with potential use in all kinds of payment process</td>
</tr>
<tr>
<td></td>
<td>Forward invoice</td>
<td>i, vii</td>
<td>Repeated in both processes and with potential use in all kinds of payment process</td>
</tr>
<tr>
<td></td>
<td>Request supplier quote</td>
<td>i</td>
<td>Repeated in both processes</td>
</tr>
<tr>
<td></td>
<td>Check item’s suitability</td>
<td>i</td>
<td>Repeated in both processes</td>
</tr>
<tr>
<td></td>
<td>Insert request</td>
<td>i, vii</td>
<td>Repeated in both processes and with potential use in all kinds of procurement process</td>
</tr>
<tr>
<td></td>
<td>Forward request to CDU</td>
<td>i</td>
<td>Repeated in both processes</td>
</tr>
<tr>
<td></td>
<td>Check funds available</td>
<td>i, vii</td>
<td>Repeated in both processes and with potential use in all kinds of procurement process</td>
</tr>
</tbody>
</table>

Table II. Model elements and heuristics
In order to represent the aspectual elements of the ownership diagram (Figure 11) we have grouped aspectual elements belonging to the same actor or related to each other. The groups are presented in Table III.

The container in the left side of Figure 11 represents the core processes and its owner, and in the right side represents the aspectual processes inside their aspect owner responsibilities area. Each aspect owner area represents the elements that this actor, more specifically in this case a position (manager in the meta model represented by specific managers or coordinator) is responsible for. The concept of owner is associated with the actor and its specialization in organizational role and owner in the meta-model in Figure 4. The elements inside the aspect owner area represent the kinds of process indicated by the function element in the meta-model. The level considered is represented as a container for both process and aspect owners’ responsibilities, in the case of Figure 11 we are presenting the design level element in the meta-model. Below each function element in the aspect owner container we will find a string, a pointer, to the AO-BPM diagram, making explicit in that diagram who are the owners (in this case at the design level) of the processes. As such, our proposed representation is able to present the actors in lanes representing either the organization sector or the person who carries out the workflow, but also the actors which are owners of the process. Figures 11 and 10 together disclosure information that contributes to a more transparent organization (Cappelli et al., 2007).

Figure 12 represents the explicit pointcuts, an internal view of how the aspects interact with the core process. Note that in Figure 10 there is no explicit links, but addresses (join points), which are known by the aspect’s pointcuts so the explicit links can be enacted as to form the whole process, as in Figure 9, without the modularity provided by aspects. In the case of business processes, besides modularity, the AO-BPM provides the opportunity to also address different actors performing factored out activities.

4.2 Results

In order to formulate the aspect-oriented models of the library’s procurement processes, the heuristics described in Section 3 were used as shown in Table II. The resulting models contain supporting elements with potential for reuse in other processes, as is the case of the procurement group.

Note that the procurement elements are quite general (e.g. prepare list, monitor procurement), and they might thus be part of any kind of procurement process, not just

<table>
<thead>
<tr>
<th>Group name</th>
<th>Elements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treat procurement</td>
<td>Prepare procurement list</td>
</tr>
<tr>
<td></td>
<td>Form procurement process</td>
</tr>
<tr>
<td></td>
<td>Monitor procurement process</td>
</tr>
<tr>
<td></td>
<td>File procurement proof</td>
</tr>
<tr>
<td>Treat payment</td>
<td>Attest invoice</td>
</tr>
<tr>
<td></td>
<td>Forward invoice</td>
</tr>
<tr>
<td>Treat request</td>
<td>Insert request</td>
</tr>
<tr>
<td></td>
<td>Forward request to CDU</td>
</tr>
<tr>
<td></td>
<td>Check funds available</td>
</tr>
<tr>
<td></td>
<td>Request supplier quote</td>
</tr>
<tr>
<td></td>
<td>Check items suitability</td>
</tr>
</tbody>
</table>

Table III.

Groups of aspectual elements
book-related. The separation of these elements in the aspectual representation underscores that they are not the responsibility of the library itself. They are performed by roles from other areas of the organization. In that case, it makes sense for them to have another owner, because one specific role can perform them exclusively, and they are more likely always to be performed homogeneously.

Unlike the original model built using traditional techniques, the representation proposed here made clear this distinction in the attribution of roles. Also, the models show clearly the relationships between actors (executors of core process activities and executors of aspect process activities) and the related process owners. For example, the acquisition analyst (aspect process) interacts with the collection development unit (core process). However, each of these processes has its owner (as in Figure 11). It is easier for the people performing these roles to know whom to report to. We did not mention execution time in the case study because we do not have data from process instances, just the models.

After explaining and presenting the models, the following questions were discussed with the library manager during an interview. The answers are summarized in italic:

1. Is it important to have only one person managing elements scattered and tangled in many processes?
   Yes, absolutely.

2. If so, what are the benefits?
   It contributes to improve process control and to attribute responsibilities about the tasks executed. Processes sometimes “get lost” at bureaucratic interfaces with other areas of the organization, people in another areas act differently. If there is one specific person to handle each part of the process it should always end up as expected.

3. Is it important to know who is responsible for the process?
   Yes, I miss defined responsibilities and obligations; seems to be a feature of society.

4. Is it important to know who is responsible for elements scattered and tangled in many processes?
   Yes.

5. How do you set responsibility for a process? What are the criteria?
   According to the internal rules and by talking to the employees. Theoretically any librarian can perform, or be responsible for, any process. In choosing who will be the owner I try not to let myself be influenced by personal capability and internal qualification gained through courses, seminars, refreshers, and technical visits as investment in employee development, nor by managers’ observations.

According to the results from the interview, the library manager described a situation in which it seems difficult to distinguish in-house tasks in general within the organization. It is also hard to identify or to allocate ownership. She concluded, looking over the resulting models, that this approach could be a way to help in this situation.

4.3 Discussion of the case at hand
In this case study, we searched evidences that might provide answers to our research question:

RQ1. How important is the representation of process and aspect ownership for the process stakeholders?
Although the participant was asked about the “knowledge” about the owners, and not specifically about their representation, we argue that she could reach this perception from the explicit representation provided in the models.

The library manager could clearly point out the benefits of a specific owner for parts of the process that occur in other, different processes, in that they are more likely always to be executed the same way, and the results to be as expected.

Another benefit is clearly established responsibilities and accountability. All these items are presented by the literature described in Section 2, but were also found to be true in the real-world. Moreover, the manager (librarian) was observed to recognize the benefits deriving from clear representation of process ownership in the new approach to aspect processes. The separation of roles in the aspectual process model also allows more specialized assignment of roles. This could lead to an internal business service-oriented organization. Controls could also be implemented in this same, internal service-oriented direction. However, additional studies are needed to explore this point in greater depth.

Another important point is that with this approach is clear to the organization the responsibility about information that is generated during process execution. The aspect manager is also the information manager, which brings to the organization a further gain in identifying the person responsible for the specific information.

With these answers from an area manager (librarian) in a real scenario, the case study indicates the benefits of our approach. These main benefits are in the line of established responsibility and accountability. It is also important to notice that the librarian declared that this scenario would make the processes more efficient and manageable.

4.4 Evaluating the proposed notation

Besides the evaluation to get evidences about the main research question about the relevance of representing process owners, it was also necessary to verify the soundness of the notation proposed. Thus, this section summarizes the results of a controlled experiment (Wohlin et al., 2000) that was conducted in order to evaluate the complexity and expressiveness of AO-BPM with ownership” when compared to BPM for describing and understanding the process owner. This brief report show details about the experiment: questions, metrics, hypotheses, execution, results, and threats to validity.

The questions used in the controlled experiment are:

Q1: what is the degree of complexity for describing the process owners using BPMN when compared to AO-BPM with i*?

Q2: what is the degree of expressivity for describing the process owners and the aspects owners using BPMN when compared to AO-BPM with i*?

Q3: what is the degree of identification easiness of the process owners that are represented using BPM when compared to those represented using AO-BPM with i*?

The respective metrics used for each question (Q1 to Q3) are:

M1 (qualitative): complexity (cpx) in terms of the difficulty provided by the modeling language for describing the process owner.

M2 (qualitative): expressiveness (exp) in terms of the complete representation of the process and aspect owners.

M3 (qualitative): identification easiness (ident) of the owners.
Hypotheses. The null and alternative hypotheses (H1-H3) corresponding to the questions Q1-Q3 using the metrics M1-M3 are synthetized as follows (Table IV). Table IV summarizes the hypothesis formulated in this experiment. For RQ1, the Null hypothesis states:

H0. The Complexity of BPM notation is equal to AO-BPM notation.
H1. BPM notation is less complex than AO-BPM notation.
H2. BPM notation is more complex than AO-BPM notation.

For RQ2, the Null hypothesis states:

H0. The expressiveness of BPM notation is equal to AO-BPM notation.
H1. BPM notation is less expressive than AO-BPM notation.
H2. BPM notation is more expressive than AO-BPM notation.

For RQ3, the Null hypothesis states:

H0. The identification easiness (ident) of the owners of BPM notation is equal to AO-BPM notation.
H1. BPM notation is less easy to identify the owners than AO-BPM notation.
H2. BPM notation is easier to identify the owners than AO-BPM notation.

Execution. In this controlled experiment, eight undergraduate computer science students from UNIRIO – Federal University of the State of Rio de Janeiro (Brazil) were selected based on a minimal knowledge about process modeling. They received two models with the library example: one in BPM and the other in AO-BPM with i* containing the process owners.

First at all, the participants answered an initial form in order to characterize the profile of each of them and collect personal information about professional expertise and skills in process modeling.

After, they conducted an analysis of the models and answered a form in which they could reply the abovementioned questions and include comments about the models and the comparison between them.

Results. All participants highlighted that AO-BPM with i* is able to modularize the process owners, providing a clear and explicit representation of the owners. The same was not observed in the modeling with BPM. Another important aspect highlighted by the participants concerns to the fact that with AO-BPM the process core is separated from the crosscutting concerns, and this modularized modeling benefits the understanding and allow an easy evolution of the model.

In summary, in terms of expressiveness, all participants clearly stated that the AO-BPM with i* is more expressive for representing process owners than BPM. They

<table>
<thead>
<tr>
<th>Null hypotheses</th>
<th>Alternative hypotheses 1</th>
<th>Alternative hypotheses 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>$H_1^g$: $cpx_{BPM} = cpx_{AO-BPM}$</td>
<td>$H_1^g$: $cpx_{BPM} &lt; cpx_{AO-BPM}$</td>
<td>$H_1^g$: $cpx_{BPM} &gt; cpx_{AO-BPM}$</td>
</tr>
<tr>
<td>$H_2^g$: $exp_{BPM} = exp_{AO-BPM}$</td>
<td>$H_2^g$: $exp_{BPM} &lt; exp_{AO-BPM}$</td>
<td>$H_2^g$: $exp_{BPM} &gt; exp_{AO-BPM}$</td>
</tr>
<tr>
<td>$H_3^g$: $ident_{BPM} = ident_{AO-BPM}$</td>
<td>$H_3^g$: $ident_{BPM} &lt; ident_{AO-BPM}$</td>
<td>$H_3^g$: $ident_{BPM} &gt; ident_{AO-BPM}$</td>
</tr>
</tbody>
</table>

Table IV. Null and alternative hypotheses
also stated that identification easiness of the owners is much better in AO-BPM with i*. However, in terms of complexity, two participants (25 percent) highlighted that the model is a bit more complex, but all of them agreed that the benefits of representing the owners is unquestionable.

**Threats to validity.** As threats to the validity of the performed experiment, two aspects can be enumerated. The first one concerns to the methodology that was adopted in this experiment. The number of participants (only eight people) is small and characterizes a non-representative sample from the population, thus making impossible to establish any kind of generalization. This small sample size also avoided the use of statistical methodologies for analyzing the results, thus being another threat to validity. In addition, it is necessary to perform the experiment taking into account others examples in order to verify if the results would be the same observed for the library example.

5. Related work
List and Korherr (2006) present a framework for evaluating BPMLs. These languages, they argue, represent some aspects of processes and some areas of application, but no comprehensive evaluation of BPMLs is available. To address this issue they propose a meta-model with a wide range of process concepts, which makes it possible to ascertain the core concepts of BPMLs and to evaluate BPML. The languages evaluated were UML 2 Activity Diagram (AD), Business Process Definition Metamodel, Business Process Modeling Notation (BPMN), EPC, IDEF3, Petri Net, and Role Activity Diagram (RAD)[1].

The meta-model comprises five perspectives: organizational, functional, behavioral, informational, and business process context. The organizational perspective is about where and by whom process elements are performed. The functional perspective represents the process elements that are performed. The behavioral perspective represents when and how the process elements are performed. The informational perspective considers the informational entities consumed, produced or manipulated by the process. The business process context perspective describes characteristics such as goals, measures, deliverables, the process owner, the process type and the customer.

The conclusion of List and Korherr (2006) is that the behavioral and functional perspectives are well represented in all the languages analyzed; the organizational and informational perspectives are partly supported; and the business process context perspective is not supported. This is highly important in view of the requirements of our approach mentioned in Section 1. The organizational perspective is present in almost all of the BPMLs except IDEF3 and Petri Net, which originated in software development and do not include the concept of role. All others languages include this concept. Only AD represents role boundaries as internal or external to the organization. AD, RAD, and BPMN use the same concept to represent all types of process participants (internal, external, software, application, service, human, role, and organizational unit). List and Korherr (2006) regard this absence of specification as hampering process enactment. The process owner, as part of the business process context perspective, is not represented in any of the seven languages analyzed. Although, the authors did not address this issue, their conclusion underlines the existence of gaps in BPM, especially as regards process ownership.

Lamb (2005) offers a model based on the concept of social actor, which claims should help researchers developing information and communication technology (ICT) studies.
This model provides a multi-dimensional view of the organization member and his use of ICTs. It contextualizes the organization members, their informational environments and their ICTs. According to the model, social actors are organizational entities, which have their interactions enabled and constrained by the socio-technical affiliations and environment of the organization, its members and its industry. The social actors have conflicting and ambiguous requirements regarding their activities and the ways they perform their work. This view considers that the world is constantly changing and that globalization influences organizational relationships. On this model, the unit of analysis is people-plus-ICT, although goals are represented simply (Lamb, 2005). In Hewitt et al. (1973) there is no representation of intentionality. As such, these proposals do not satisfy our requirements as stated in Section 1.

Becker et al. (2000) proposed guidelines of modeling to improve the quality of process models through six guidelines for the product (model) and the process (modeling activity). The guidelines rest on the following principles: correctness, relevance, economic efficiency, clarity, comparability, and systematic design. In addition to the six general guidelines (level 1), they also include recommendations for different views (level 2, e.g. process models) and for different modeling techniques (level 3, e.g. EPC or Petri Nets). According to Becker et al. (2000), perspectives on process models concern the persons involved and the modeling goal. For example, a model for a workflow specification should describe, e.g., control flow, data flow and program parameters, while a model for an organizational handbook generally includes organizational information, such as process owner and roles. Nevertheless, they state that every function in a workflow model, if not completely automated, must include a link to an organizational construct. They affirm that organizational constructs are generally: role (in the sense of a qualification or a competence), organizational unit (whether permanent or temporary like a project team), position, position type, and person as static information. However, a workflow owner should be specified for the entire workflow (Becker et al., 2000). Despite these observations, the metamodel they describe does not explicitly include information about process owners (or the concept), and neither is any kind of graphical representation proposed.

Smirnov et al. (2012) also state that for each modeling goal, a specific process model is designed. This can become a problem, since companies keep repositories with very large numbers of models. The stored models have complex interrelations: they may overlap, describe processes that subsume each other, or even describe the same process from different perspectives. They suggest the business process model abstraction, presented in many works drawn from the literature (Bobrik et al., 2007; Eshuis and Grefen, 2008; Polyvyanyy et al., 2008; Streit et al., 2005 apud Smirnov et al., 2012), as a solution to this problem, and they also propose a set of specific use cases to define important abstractions. One of the use cases (Smirnov et al., 2012) deals with a kind of view that concerns activities performed by specific roles (Use Case 13: get process quick view respecting roles – activities performed by a special role, e.g. manager, are considered to be significant. The rest of activities are not. Insignificant activities are aggregated into coarse-grained ones, significant activities are preserved as it is, and the ordering constraints are preserved where possible. Non-functional properties of the process, e.g. execution time or execution cost, should be preserved). The stress is on performance of activities, not on responsibility for the process. No use cases (meaning that no important view exists) consider the relationship of the process with its owner.
The i* framework is conceived as a social modeling framework where the central concept is the actor. Actor modeling was first used as a modeling concept by Hewitt (1986) as a way to model the work done in organizations (called “office work”). An actor architecture and method proposed in artificial intelligence (Hewitt et al., 1973) is based conceptually on the actor object. In this context, an actor is an active agent that plays a role according to a script. The actor metaphor was used to emphasize the absence of separation between control and data flow in the model of Hewitt et al. (1973), on the other hand, contrary to the strategic actor diagram (Leite et al., 2007), the actor model (Hewitt et al., 1973) does not deal with actors within the context of intentionality as in i* (Yu, 1995). Another approach to representing how organizations operate is DEMO (design and engineering methodology for organizations) (Dietz, 2006). In this approach, an organization is based on the operational principle of entry into and compliance with commitments through communication. The communication occurs between human beings who play actor roles. According to this methodology, it is possible to identify the essence of organizations represented in ontological transactions. The diagrams used to represent the conceptual models of this methodology have the actor role concept, but ownership – in this case, of the ontological transaction – is not discussed or addressed. He shows how data ownership is neglected, because one can choose to set the data owner as the initiator or the executor of the transaction, but his study does not mention any way to represent this ownership.

Kohlbacher and Gruenwald (2011) explore empirically the interaction effect of process performance measurement and the process owner role on organizational performance. They use multivariate data analysis techniques to test the joint effect of process performance measurement and process ownership on firm performance. The evidences indicate that implementing process performance measurement or the process owner role only is insufficient to achieve high performance. Organizations must implement both concepts – process performance measurement and the process owner role – to reap the fruits of process management. Although this work states clearly that the main difference between a traditional and a business-oriented management approach is the existence of the process owner, the authors do not address the representation of such concept within the process models.

6. Conclusion
In this paper we argue the importance of clearly established process ownership, both of the core process and the aspectual process.

In order to meet requirements aligned in the introduction, we presented an approach to represent the actor involved in process and aspect ownership as an instantiation of the i* strategic actor. Using this approach, the process owner can be defined in terms of actors instead of the activities performed. It is also possible to define the aspect owner and to include the aspectual process concept in the business process model. In order to differentiate process design and process execution we proposed a representation which is compatible with both EPC and BPMN meta-models.

We also presented evidence both from a case study in a real-world library showing the importance of representing – previously unavailable – process owner information, and from an experiment that involved participants analyzing the same models of the case study, confirming the preliminary evidences. It is important to stress that although the interview protocol did use leading questions to confirm the necessity of
untangling different responsibilities, the important point is the recognition by the librarian that the proposed representation provided more transparency, in terms of ownership, than the usual BPM models. These benefits are due to the combination of the aspect-oriented approach and the strategic actor model, providing ownership information in a more transparent way.

This work has implications for both research and practice. In the research perspective, we advanced the notion of process ownership since our proposal helps to relate the set of owners that a process might have extending well-known meta-models to address it. Moreover, in the practice perspective, it has the potential to support an organization to make the ownership as whole more clear and understandable for all the stakeholders by the graphical representation.

Future work will aim to include our model in the generic business process meta-model presented by List and Korherr (2006). By doing so, we will complete the framework with detailed ownership information and enrich the business process context perspective. Another possibility is to improve this research by focussing on criteria to establish process and aspect ownership in a real-world organization.

To facilitate the use of our approach, we intend to develop a tool to handle the representation proposed in this paper – the view comprising aspect and process owner, together with the elements (activities, data, systems,) they are responsible for, and the view of the business process as modeled. We will also have to explore the representation at the execution level.

Note
1. This is the classification used by List and Korherr, which includes languages not designed for business processes, such as Petri-Net and IDEF3.

References


Further reading


About the authors

Julio Cesar Sampaio do Prado Leite PhD University of California, Irvine (1988). Member of the IFIP 2.9 Working Group. Founding Member of the Brazilian Computer Society. Member of the Editorial Board of the Requirements Engineering Journal. Keynote Speaker (2006) for the Brazilian Software Engineering Symposium. Co-founder of the Workshop on Requirements Engineering (WER) series. Advisor to 12 PhD dissertations. Author or Co-Author of 26 journal papers and 127 full conference papers. Member of the IEEE Computer Society and Member of the ACM. Professor Leite has served as a Program Committee member for more than a hundred conferences and workshops.

Flavia Maria Santoro is an Associate Professor at Applied Informatics Department of the Federal University of the State of Rio de Janeiro, Brazil. She received her PhD and MSc Degrees in Computer Science from the Federal University of Rio de Janeiro (COPPE-UFRJ). She has experience in Computer Science, focussing on Information Systems, acting on the following subjects: business process management, knowledge management, computer-supported cooperative work and computer-supported collaborative learning. Flavia Maria Santoro is the corresponding author and can be contacted at: flavia.santoro@uniriotec.br

Claudia Cappelli is a Professor at the Federal University of the State Rio de Janeiro (UNIRIO), Brazil. She received her PhD Degree in Computer Science from the Pontifical Catholic University of Rio de Janeiro (PUC-Rio), Brazil and MSc in the Federal University of Rio de Janeiro (UFRJ), Brazil. Her current research interests include process transparency, aspect-oriented BPM, business process management, IT architecture and electronic government.

Thais Vasconcelos Batista is an Associate Professor at the Computer Science Department of the Federal University of Rio Grande do Norte (UFRN), Brazil. She received her PhD Degree in Computer Science from the Pontifical Catholic University of Rio de Janeiro (PUC-Rio), Brazil. Her current research interests include software architecture, aspect-oriented development, business process modeling, and distributed systems.

Fabiana Jack Nogueira Santos received her Master Degree in the Federal University of the State of Rio de Janeiro (UNIRIO), Brazil. Her current research interests include aspect-oriented BPM, business process management, and IT architecture.

For instructions on how to order reprints of this article, please visit our website: www.emeraldgrouppublishing.com/licensing/reprints.htm
Or contact us for further details: permissions@emeraldinsight.com