Business Process Compliance in Partially Observable Environments

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Abstract. This paper addresses how to design and implement business process compliance through observing the business process instances and controlling the business process models, considering environments that are only partial observable. An organization is a dynamic system where actors assume roles and produce results and decisions autonomously, changing the overall state of the system. These decisions often occur in environments that are not fully observable. The business process models are intended to represent an organizational reality and restrict the freedom of design to allow common understanding between stakeholders and to define the roles of the actors. Therefore, organizations need to ensure that operational processes are performed in a controlled way to meet predefined requirements, complying with regulations, laws and agreements established between internal and external stakeholders. The solution is implemented using Enterprise Cartography (EC). The results obtained demonstrated the ability to observe and control the process instances as a contribution to improving the compliance of business process.

Keywords— Compliance, Enterprise Cartography, Business Process Models, Development process, Observation, Control

1 Introduction

An organization includes a network of people and machines that work and communicate in an integrated way. While organizations operate to meet optimization requirements to increase their effectiveness and efficiency, unexpected endogenous and exogenous situations occur continuously. The control and management functions are responsible for optimizing the use of runtime resources. The organizational activity can be divided into three intervals: ex-ante: what happens before execution of business process; ex-dure: during execution; ex-post: after the executions. This phase includes decision-making processes to estimate future behaviour from the data available from past executions. Integration of these three time intervals provides a complete description of control of organizational behaviour and leads to the problem that organizations have an incomplete understanding of the facts and yet, have to make ex-post organizational decisions based on information collected in partially observable environments. This occur when not all transaction states information is available. This problem is recognized with high impact in the health industries, financial, public administration, etc. The problem addressed will be solved taking into account the scientific contributions of EC. The solution consists in enforcing observation and control business process instances using Atlas tool and a business process model, modelled in BPMN.

2 Design Science Resources Methodology

This investigation use Design Science Resources Methodology (DSRM). DSRM consists of an interactive process with six steps and includes rigorous methods for the creation and evaluation of the proposed artefacts[11]. The following DSRM steps are demonstrated in Figure 1.

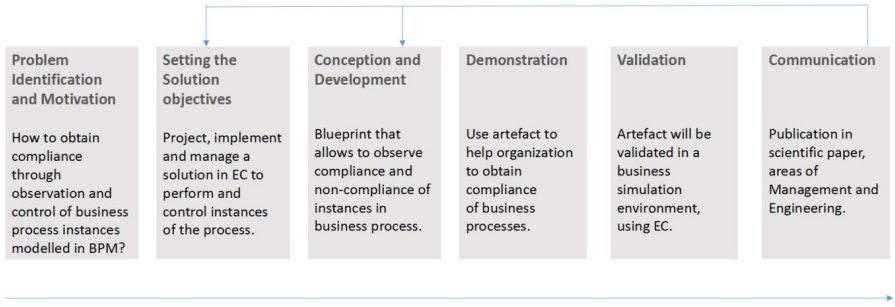

Figure 1: DSRM process adapted from Peffers et al[11]

3 Background

3.1 Enterprise Cartography

An organisation can be abstracted as a dynamic system where a network of actors collaborate and produce results that can be depicted using cartographic maps[2]. Actors collaborate with each other over time, creating a dynamic network and produce autonomous behaviours that can change the overall state of system, only be observed after actions end. EC is fundamental to managing the transformation processes of an organization. Transformation is seen as the set of initiatives that change the current state to an intended state. The two states span organizational variables at different points in time. The as-is status represent variables that have changed due to past events, the to-be state represents an expected state configuration of the organizational variables. Between these two states the organization reacts to other events triggered by the operation of the transformation processes. It is important to observe and manage the organization during the transition of states, even if some of the events may not be related to the transformation activity because it can condition the transformation process by diverting the organization from the objectives.

3.2 Business Process Compliance

Compliance verification is a very current issue of great importance in communities to management and auditing business process, due to the availability of event data on one hand and by the other hand, due to changes in legislation[4].

Compliance means to ensure that business practice and processes are aligned at commonly accepted norms[5]. Organizations need to continually check whether processes, supported by information systems, are executed within a set of limits. The deviations can be pointed out as negligence, frauds, risks and inefficiencies. Increasingly, organizations are subject to laws and regulations, in compliance with contractual standards and obligations and there is a need to optimize response times for processes subject to these guidelines. Information systems also increase the risk of illusion of control, which means that information systems present information that does not reflect the actual instances of the process[10].

3.2.1 Actor

Actors of an organization are the fundamental part of a company and are organized in social systems (Winograd, T. 1986). For the performance of an activity, an actor explicitly or implicitly fulfils a certain role. These actors are endowed with their own will and freedom of action, acting according to their purpose and orchestrations[16]. They are therefore autonomous in deciding what to do next. In companies, some tasks can be automated by software systems, while others are performed by human actors.

3.2.2 Model and instance of a business process modelled on BPM

BPM it is about managing entire chains of events, activities and decisions that ultimately add value to the organization and its customers. These chains of events, activities and decisions are called processes."[9]. Business process as a collection of inter-related events, activities and decision points that involve a number of actors and objects, and that collectively lead to an outcome that is of value to at least one customer. Figure 2 depicts the ingredients of this definition and their relations. BPM involve different phases and activities in the life cycle of the business process. It is necessary that the previously designed models be implemented in systems and be contained in the organization, so that they can be instantiated later[16]. A business process model defines which roles of the actors are involved in each transaction state. It is these same actors who instantiate the transaction states of the business process.

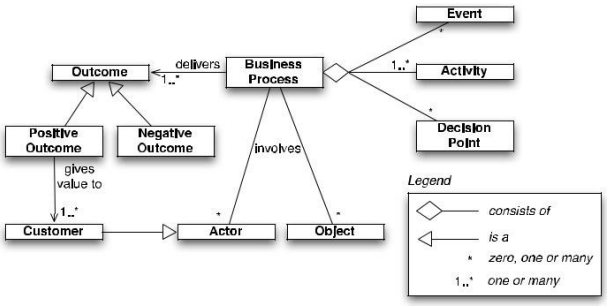

Figure 2: Ingredients of a Business Process[9]

3.2.3 Observation

Observation is one of the stages of the scientific method and consists in understanding, seeing and not interpreting. And it refers to the action and result of observing something or someone. In control of dynamic systems, Franklin et al. (2009) state that "...a system is completely observable if each system state variable affects some of the outputs. If any of the states cannot be observed from the measurements of the outputs, the state is said to be unobservable and the system is not completely observable or simply unobservable ... ".

3.2.4 Control Actions

In a system there are two types of control variables, those who are controllable and those that are not controllable. Franklin et al.(2009) refers "...a process is named fully controllable if each state variable of process is controlled to achieve a certain objective in finite time by a control u(t) without restrictions. If any of state variables are independent from control u(t) meaning that there is no way to act, in finite time from that state variable to the desired state. Therefore, this state in particular is denominated as uncontrollable, so the system is called not totally controllable or simply uncontrollable."

3.2.5 Time

Conceptually, everything that happens before the execution of business processes is called ex-ante, for example, the prescription of business processes. What happens after the execution of business processes is called an ex-post, relating, for example, to the reaction that is needed when something unexpectedly occurs. The decision processes on the most correct action u(t) to be taken consider the ex-ante models of the business processes as a control reference to be followed.

3.2.6 Control Pattern

The goal of the control is to allow the operation of the business process instance(s) to be conducted, using a limited effort to a stable state previously defined by the organization[16]. And being able to react to the exogenous and endogenous changes and disorders that are occurring. In conceptual terms, Kuo (1995) defines the stability of a system as "...considering the response of a system to inputs or perturbations: a system that remains in a constant state, except when it is affected by an external action, but is capable of returning to the initial constant state soon after this external action is removed then can be considered stable. . . ".

4 Solution Proposed

4.1 Atlas

Atlas is a EC tool that supports the organizational transformation of an organization. Atlas is an automation-based solution to enable efficient management of Enterprise Architectures. It enables organizations to: i) Capture information from enterprise repositories providing a conciliated view of the organization. ii) Create, customize and analyze repositories. iii) Time-travel. The proposal for the solution is made using the Atlas tool, a commercial tool that is used in several medium and large corporate architectures[2].

4.2 Problem Clarification

In order to explain the problem to be solved, we used the process modeling in BPMN, view Figure 3. This process was created by the company where our case study focuses, Link Consulting.

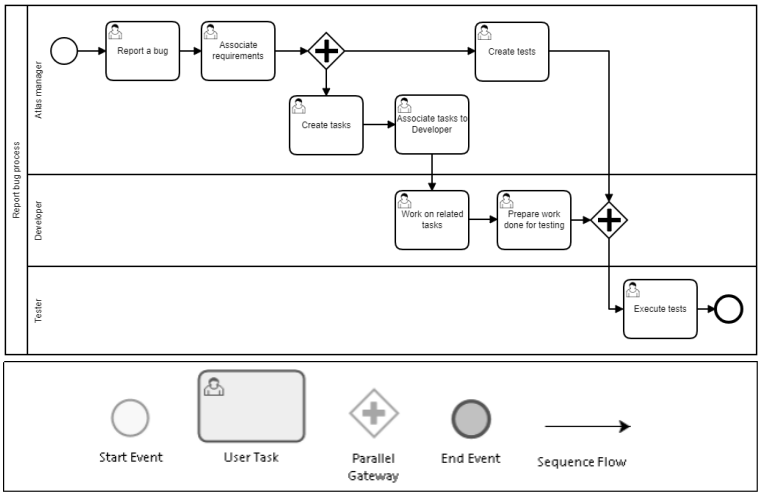

Figure 3: BPMN Process Report a Bug

Figure 4 shows the Form, produced by the Atlas tool. Whenever an actor find a bug, he must register it through the Bug Form.

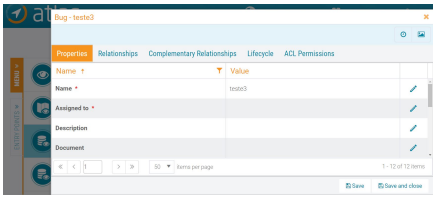

Figure 4: Form Report a Bug

An actor in this context can be an Atlas manager, a programmer or a tester. Registration of Bugs allows that the company has a repository of the bugs found and reported by the actors; and give to company the ability to observe at any time current state of a particular Bug by actor.

4.2.1 Transaction states

When the instances of the Report a Bug process are executed, they go through three states: **ex-ante**, **ex-dure**, and **ex-post**. It is during the ex-dure phase that non-compliance can occur. The restrictions correspond to the business rules identified by the company and serve to ensure compliance in the execution of the instances of the business process.

			RB_StarteEvent	RB_Report Bug	RB_Associate Requirement	RB_Create Tasks	RB_Associate Tasks to Developers	RB_Work on Related Tasks	RB_Prepare Work done for Testing	RB_Create Tests	RB_Execute Tests	RB_TerminateEvent
Activity				x	x	x	x	x	x	x	x	
Event			x									x
Property	Name / Assigned to (*)			x	x	x	x	x	x	x	x	
	End Date										x	x
	Owner			x	x	x	x	x	x	x	x	
	Requirement				x	x	x	x	x	x	x	
	Start Date			x	x	x	x	x	x	x	x	
	State	Start				x	x	x	x			
		On Going		x	x							
		Finished									x/or	
		Validated								x		
		Rejected									x/or	
	Tests								x	x	x	

Figure 5: Matrix of Decisions Associated with Report a Bug Activities. In Red: Compliance restrictions

4.3 Conception and Development

The proposed solution is to create an artifact - Blueprint, which allows to show the compliance and non-compliance that occur during the execution of the instances of the Report a Bug process, by actor.

1. Create Class SystemBPMN

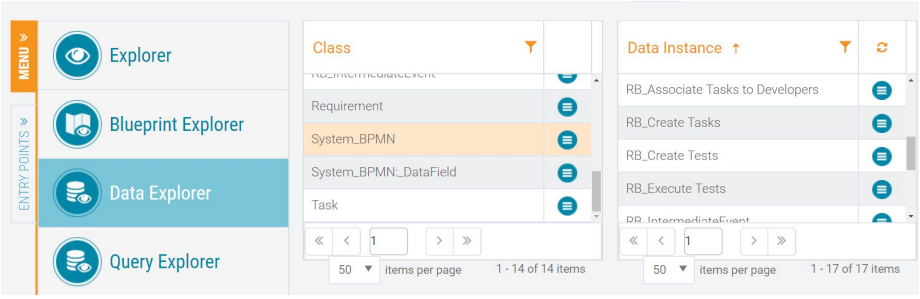

Figure 6: Class SystemBPMN and some instances from process Report a Bug

2. Creation of Blueprint in ERML language, using the Atlas tool.

Algorithm 1: All Instances Algorithm

```
Data: All Bugs
Result: List of compliance bugs and non-compliance bugs from all instances
begin
    if (instance = "Report A Bug") then
        if (Start Date != NULL) and (State == On Going) then
            Compliance = TRUE;
        else if (Start Date == NULL) and (State == 0) then
            Compliance = FALSE;
    end
    if (instance = "Associate Requirements") then
        if (Requirement != NULL) then
            Compliance = TRUE;
        else if (Requirement == 0) then
            Compliance = FALSE;
    end
    if (instance = "Create Tasks") then
        if (State == Start) then
            Compliance = TRUE;
        else if (State == 0) then
            Compliance = FALSE;
    end
    if (instance = "Create Tests") then
        if (State == Validated) and (Tests != NULL) then
            Compliance = TRUE;
        else if (State == 0) and (Tests == 0) then
            Compliance = FALSE;
    end
    if (instance = "Prepare Work Donw for Testing") then
        if (Tests != NULL) then
            Compliance = TRUE;
        else if (Tests == 0) then
            Compliance = FALSE;
    end
    if (instance = "Execute Tests") then
        if (State == Finished or State == Rejected) and (End Date != NULL) then
            Compliance = TRUE;
        else if (State != Finished or State != Rejected) and (End Date == 0) then
            Compliance = FALSE;
    end
end
```

3. Blueprint

In IT domain, Blueprints have always been perceived as an important asset, especially by IT architecture teams or departments. Enterprises would be better understood if they could have a Blueprint (schematic representation)[7]. They represent a common way of communication between people, namely to express an architectural description of things, like a system, an object, a model or in our case, an enterprise[7]. Figure 7 show Blueprint from actor Miguel Correia.

Blueprints are automatically generated and represent the compliance and non-compliance of the instances of the process Report a Bug.

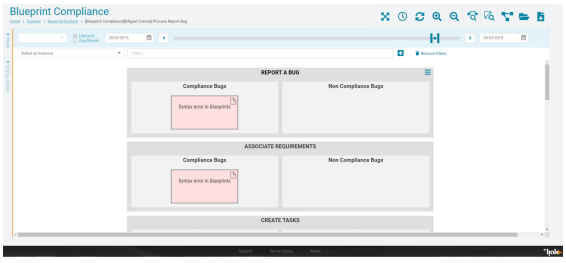

Figure 7: Blueprint Canvas page

5 Demonstration

The application in real context, from this solution, aims to provide the company with greater compliance in the business process instances, at runtime: ex-dure. The compliance achieved by complying with the predefined restrictions allows the organization to have a better understanding of what is going on in the company, rewarding it in decision making. Memory of the past state (as-was) and the future state (to-be) define the behaviour of an organization. To-be state specifies the goals of transformation projects. Without to-be state the transformation processes cannot be executed or measured since no project goals are defined[2]. During the study period, 80 instances of Report a Bug process were considered. Corresponding to 480 operations performed by the actors, we can observe 78 instances of the 80 contemplated, divided by activity, between compliance and non-compliance. Based on the initial problem - how to design and implement business process compliance through observing the business process instances and controlling the business process models, our investigation concerns the beginning of a solution to find compliance, once that simulation occurs of a just one business process. The goal is to extend this solution to any business process, provided that is modelled in BMPN, and to any organization.

6 Conclusions

This article presents an innovative solution that allows to observe compliance, ex-dure, during the execution of business process instances using EC. The results obtained through the simulation, show us that through the EC it is possible to observe the compliance and non-compliance associated with each instance of the business process. Thus contributing so an operational improvement in the execution of business processes modelled on BPM. We can more easily identify deviation situations in order to carry out corrective actions to encourage the actors that operate in the instantiation of the business process. When compared

with existing solutions, this solution allows the identification of situations of deviation from the prescriptions, ex-dure, during the execution of the instances. In order to achieve greater compliance, is identified the need to: i) Increase the actors' awareness of compliance with restrictions introducing the concepts explained by Dietz - production acts and coordination acts. ii) Create an automatism from solution, that allows the observation and controlling the process instances during transaction state, ex-dure.

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