

# A Goal-Oriented Approach for Workflow Monitoring

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**Abstract.** Nowadays, the use of software systems implemented for automatically guiding and monitoring business processes is becoming a common option in modern enterprises. This kind of systems (workflow management systems) is designed to monitor tasks, documents, rules, computers etc. To do this, these software systems implement an automated representation of the enterprise processes. In most cases, these systems are mainly oriented to capture the tasks performed in the business from a process-based view. However, current workflow systems have neglected the goals and objectives that enterprise wants to achieve with the performance of business tasks. Therefore, in current workflow approaches, it could be very complicated to determine if these tasks actually satisfy the business goals. In this paper, the framework Tropos is used to model the goals of the business processes and also, to establish the mechanism to control and monitor the goals of each one of the actors involved in the process. With this, it is possible to measure the impact of the fulfillment of the actor goals in the satisfaction of the enterprise goals. A software tool, called GoalFlow has been developed in order to validate the proposed methodology. This approach enables the managers to take the appropriate decisions according to the knowledge on relevant aspects in process execution: who, what, how, and why.

**Keywords:** goal business, workflow management systems, monitoring task.

## 1 Introduction

Nowadays, it is very frequent for the current enterprises to apply systems to improve their efficacy in productive and management aspects. In this context, some of the most used mechanisms for these purposes are the workflow systems, which are very useful for the enterprises to perform their functions. Systems of this kind arose to improve the efficiency by putting together persons, process and machines [1]. The objective of workflow systems is to automatically monitor and control the components of business process by using a software system installed in the enterprise's network that implements an automated representation of the business processes. Tools and languages such as BPEL, XPDL, YAWL, openEDMS, OnBase, LiquiOffice, Cardiff o Bonita are the most well-known approaches for workflow modeling. All these tools offer a strong base to process model and these are becoming more popular every day. However, despite the advantages of the workflow systems, there are certain issues that need to be solved to allow these systems to make deeper

analysis of key aspects of the enterprise structure and the organizational behaviors, such as goals, dependencies, tasks, etc. Almost all current workflow approaches have modeling limitations, primarily because they are mainly based on representing the business tasks and they have neglected the use of goals and objectives to have a more complete view of the business processes. Therefore, in some cases, current task-based approaches cannot be enough to model a specific context.

In this paper, a goal-based approach is proposed to monitor and control the processes defined in a workflow system. To do this, the Tropos Framework [2] is used to determine the impact of the fulfillment of the actors' goals in the satisfaction of the enterprise goals. It is important to point out that  $i^*$  Framework could be also used in this context. A software tool, called GoalFlow has been developed in order to validate the proposed methodology.

The paper is structured as follows: objectives of our research are described in the next section. Scientific contributions are presented in section 3. Conclusions are reported in section 4. Finally, in section 5, ongoing and future works are sketched.

## 2 Objectives of the research

In this paper, a goal-based approach is proposed to improve workflow systems with the objective of exploiting the strengths of goal approaches for enabling the analysts to detail, trace and monitor business processes. Therefore, our objective is to monitor the performance of the business tasks based on the fulfillment of actor and processes goals. The idea of this approach is to integrate the specific goals of the business actors in the fulfillment of the enterprise goals. It is important to point out that current approaches to goals-processes alignment (such as the works of Nurcan [3], Bider [4], Soffer [5], etc) offer well-founded methods to manage goals in software lifecycle. Therefore, all goal-based techniques of these approaches could be applied in the method presented in this paper.

The proposed approach is composed by two main processes. The first process consists of defining the method to model business process from a goal perspective. Second process consists of defining the method to control and monitor business process. To do this, a set of metrics and axioms to measure process performance have been defined. Figure 1 shows the proposed approach to monitor processes based on business goals, where the fulfillment of actor goals contributes to completion of the enterprise processes.

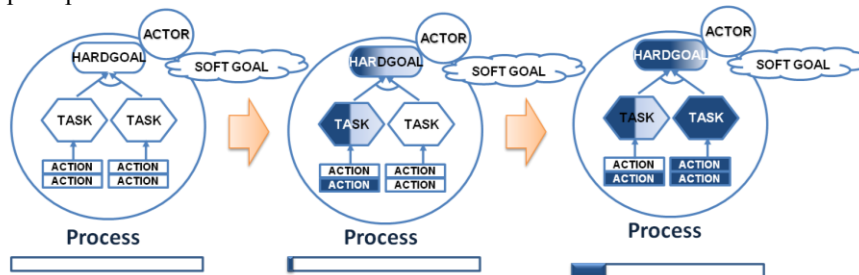


Fig. 1. The proposed monitoring method

The powerful characteristics of goal modeling are used to determine how, why, and when the actors develop tasks and processes in the business. To validate the proposed approach a software tool has been created to control and monitor business processes based on relevant aspects for their execution. It is important to point out that in our approach the goals are the mechanism used to ensure the logic connection among these aspects.

The use of goals in monitoring and controlling activities will allow to incentive the work of the stakeholders by making explicit the impact of the satisfaction of the individual goals of each business actor in the fulfillment of the business goals. In this context, all participants can be motivated by the explicit importance of their task in the business and also the participants could determine their role in the network of collaborations of each process.

According to this objective, a goal-based framework was needed to capture all relevant aspects to be modeled (who, where, how and why). We consider Tropos to be the appropriated framework for this purpose. Following, the advantages of using Tropos in this project are detailed:

- Tropos dependencies enable the analyst to determine the impact of relationships in the executions of the tasks involved in the processes.
- By following the trace of the main goals of the actors it is possible to monitor the state of the fulfillment of the milestones of the business processes.
- By refining each goal (until the level of task is reached) allows the analyst to monitor the performance of each actor and also to model the impact of this performance in the global processes.

The Tropos concepts used in this work are the following: actor, believe, capability, resource, hardgoal, softgoal dependency and task. One of the relevant concepts in this proposal is the Tropos plan because it permits to associate Tropos and Workflow concepts. We have added the concept of action to detail the Tropos plans.

Our Tropos-based method to model business processes is composed of seven steps, where the input of this method is the information of the business process to be modeled, and the output is a goal-based business process model. The steps of the method are the following: a) obtain, explore, analyze all possible sources that describe the process activities and its environment, b) identify the objectives of the process and their features, c) identify the actors that are responsible for executing some activities in the business processes, d) identify the capabilities and beliefs of each actor, e) identify the activities that are needed to carry out a process. These activities are structured in hardgoals and softgoals. Later on, these goals are associated to the actors responsible for its execution, f) refine each hardgoal identified in the previous stage. The refinement is carried out by specifying the set of the tasks needed for the execution of a goal. Later on, the required actions to execute each task are identified. The resources used in each task and action are also identified in this step, and finally, g) define the dependencies among the actors.

In this proposal, we have use metrics and axioms to implement the process to control and monitor the business processes defined in previous steps. The defined metrics allow us to quantify the progress of each one of the goals, besides quantifying the progress of each one of the modeling processes. We used the GQM approach (Goal-Question-Metric) of Basili and Rombach [6] in order to specify measurement objects. This is the first stage of the process to define metrics for business processes.

The GQM approach helps to derive meaningful questions to characterize the goals in a quantifiable way. Table 1 shows this metrics defined for our approach and its definition.

**Table 1.** Metrics for the goal-oriented business process.

Metric	Description	Axioms
<b>Size of the process</b>	Total size of the process measured according the number of actions that compose it.	An action $a$ represent $100/z$ % of a process $P$ and $z$ is the number of actions in the process $P$ .
<b>Process performance</b>	Progress in the execution of the goals and the tasks as the relation between the number of actions that have been executed and the total number of actions of a process.	Given a task $t$ composed by a set $A$ of $x$ actions and an action $a$ represent $1/x$ of a task $t$ , the fulfillment of the action $a$ increase the progress of a task $t$ . A task $t$ is finished when the actions $x$ that composed it are also finished. <p style="text-align: center;">If (<math>A == finished</math>) then task <math>T = finished</math></p> Given a hardgoal $m$ composed by a set $B$ of $w$ actions in $n$ tasks, and an action $a$ represent $1/w$ of a hardgoal $m$ , therefore, the fulfillment of an action $a$ increase the progress of a hardgoal $m$ . A hardgoal $m$ is finished when the set $B$ of actions that composed it are also finished. <p style="text-align: center;">If (<math>B == finished</math>) then task <math>T = finished</math></p>
<b>Efficacy in process completion</b>	The advance in process execution as the relation between the number of actions involved in hardgoals and the process size.	Efficacy in process completion is $(100/z) * c$ % of a process $P$ given $z$ is the number of actions in the process $P$ and $c$ is the number of actions involved in hardgoals.

### 3 Scientific contributions

The main two contributions of this research work are pointed out: a) using a Tropos-based approach to control, trace and monitor the enterprise goals. It is important to point out that Tropos framework has been extended in order to consider monitoring activities over activities, tasks and goals. b) to make explicit how the actor tasks have impact in the satisfaction of the business goals.

The GoalFlow Tool has been developed in order to validate the proposed methodology and is composed by three main stages: actor modeling, goal modeling and finally, project monitoring and project management:

**Actor modeling:** In this stage the analyst must define the actor model (using Tropos) for each one of the workflows that is needed to analyze. The actor model has been adapted to indicate the start and end of the goals besides the dependencies. The softgoals are modeled in this stage to demonstrate the rate of contribution of the individual goals in the general objectives of the enterprise.

**Goal modeling:** The objective of this stage is to develop the goal model focus on specifying how the actor goals will contribute in the business goals. Once the actor and goal models have been created, a modeling stage is performed with the objective of creating a data tree that reflects the flows of works where the actors must collaborate regarding their assigned goals. In this stage, the analysts have a graphical

view of the organizational processes focus on representing how the goals are satisfied by plans that use resources to operate.

**Project control and monitor:** The objective of this stage is to determine the state of the business tasks and the progress in the actor goals. In this stage the managers have a complete view of the execution of the project regarding the fulfillment of individual goals and process goals. Several aspects related to actor performance can be visualized, also it is possible to visualize the way the actors interact among them to satisfy the business goals. This view of the complete state of the processes enables the project manager to take decisions about process performance.

## 4 Conclusions

In this paper, a goal-based approach is presented that use the Tropos Framework as a mechanism to monitor and control the Workflows of an enterprise. The use of this Tropos-based approach enables the analyst to establish the collaboration, cooperation and coordination at the business tasks (through the concept of dependency), and also enables the manager to determine the impact of these tasks in the fulfillment of the enterprise goals. To validate this approach, a software system (GoalFlow) was developed to apply the proposed approach in real uses cases.

## 5 Ongoing and future work

At present, we are working in developing a software system to manage the knowledge generated by the business actors. The system will also store the skills of each actor and the real participation and performance of each actor in the projects,

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