ANALYSIS OF BUSINESS PROCESSES BASED ON WORKFLOW MANAGEMENT SYSTEM

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ABSTRACT

This paper discusses ways of analyzing business processes where typical approaches based on Petri Nets are mentioned. This document also describes the idea of using OLAP technology for analysis of audit data captured from Workflow Management System. If we combine process definition and workflow audit data, we can get another useful information which we could not gain keeping these data separately.

1 INTRODUCTION

A complexity of business processes increased therefore larger companies tend to the process-oriented management. Workflow Management System (WfMS) tries to deal with demands on the process-oriented management. WfMS provides functions for managing processes according to Process Definition, assignment resources to tasks in a process, monitoring, auditing, etc.

Workflow Management System is also a very helpful tool for the business process optimization as it can monitor and audit all processes. Audit Logs can be further used for analyses.

The analysis of business processes is a pre-condition for a successful process optimization. Details about methods will be described later.

2 WORKFLOW MANAGEMENT SYSTEM

Workflow Management System is used for automation of business processes. It can manage a mutual cooperation of WfMS participants (including human and software interaction) in order to perform a process. It can also help a company to adapt to changes in business processes. An overview of Workflow Management System is summarized in [5].

According to [2] Workflow Management System should consist of:

- Process Definition Tool,

- WFM Engine,

- Worklist Handler,

- User Interface.

There are interfaces (more in [4]) defined between components listed above in this architecture. Hence, it should be possible to change the component even from foreign vendor. For example, we could use a specialized Process Definition Tool with the WfM Engine which is already deployed in a company.

A creation of the process definition is the first part of the process of deployment in Workflow Management System. This is usually done by Process Definition tool. A process described by WFDL (Workflow definition Language) is an output of this tool. Casually used XPDL (XML Process Definition Language) and BPEL (business Process Execution Language) are used as WFDL.

Process definition should include information about tasks including information who can perform the task (mostly role-based approach), information about routing between tasks. Business process execution logic can be described as routing mentioned later more in detail.

The process definition is transported to WfM Engine, where one process definition can be launched as a process instance. Instances (particular processes) originate from the process definition.

Worklist Handler manages an assignment of the task to resources e.g. human, software (mostly web services) after launching of the process instance.

All information about performance of particular process can be audited for monitoring and analysis purposes. More information about Workflow architecture can be found in [2].

3 ANALYSIS OF BUSINESS PROCESSES

A contribution of Workflow Management System (WfMS) can be also monitoring of current states of all the process instances. The monitoring is very important for successful managing.

We can analyze business processes in several ways:

- Analysis based on process definition,

- Analysis based on audit data.

Analysis based on process definition is mostly based on Petri Net formalism.

Process definition could be defined directly as Petri Nets as briefly showed later or it is possible to map other languages to Petri Nets and then analyse. In [8] we can find mapping BPMN (Business Process Modeling Notation) to Petri Nets. Process definition tool can support analysis in the modeling process period. We can also make a simulation of a business process before we decide to pass it to WfM Engine.

However, there can be a lot of instances in progress and it is not easy to determine a probability of ad hoc events. Also, performance of resources could change. There are more reasons why simulation based only on process definition would not give precise results.

We can actually make simulation on reality because of making audit on WfMS. We can make a model based on process definition. We could also use audit data to set up values for a simulation based on the process definition.

4 MODELING WORKFLOW USING PETRI NETS

Petri Net formalism is widely used to model dynamic aspects in system. There is a large number of tools already available, more information in [9]. We can detect deadlocks and traps because of Petri Nets, more information in [7].

Petri Nets consists of places, transitions and arcs. Places represent conditions in workflow. Transitions represent performing task. Oriented arcs connect places with transitions. We can simulate performing process under conditions by moving tokens from places to places in Petri Net.

We use specific patterns in Petri Nets to model: AND-split, AND-join, OR-split, OR-join. According to [3] AND-split is a point within the workflow where a single thread of control splits into two or more threads which are executed in parallel within the workflow, allowing multiple activities to be executed simultaneously.

AND-join is a point within the workflow where two or more parallel executing activities join into a single thread of control.

OR-split is a point within the workflow where a single thread of control makes a decision upon which of available branches to choose.

OR-join is a point within the workflow where two or more alternative activities workflow branches join back to a single common activity.

According to [1] there are four types of routing:

- sequential routing,

- parallel routing,

- selective routing (we choose on of task),

- iteration.

For sequential routing it is necessary to perform one task after another, there are dependencies between them. All tasks run concurrently in parallel routing, construction consists of AND-split and AND-join. In selective routing, just one branch is performed, construction uses OR-split and OR-join. In iteration routing, certain part of Petri Net is repeated until the appropriate condition is passed.

More information about modeling business processes can be found in [1] and [6].

5 USING OLAP ON AUDIT DATA

Amount of audit data constantly increases by running WFM Engine. Summaries based on audit data are usually required because of huge amount of data. Workflow engines can also cooperate hence more data storage places usually exist.

Online analytical processing (OLAP) is used for multi-dimensional analytical queries. In the core of any OLAP system there is a concept of an OLAP cube (also called a multidimensional cube or a hypercube). It consists of numeric facts called measures which are categorized by dimensions.

OLAP cube from audit logs could have these dimensions:

- resource (human resources, software),

- time,

- instance (particular process),

- process (One process can have more instances.),

- task.

Resources can be grouped together into a hierarchal structure (an organization unit or a web services hierarchy). Time can be aggregated into time periods. Instances can contain subinstances, process can contain subprocesses hence we can aggregate data according to these dimensions.

For example we could ask Workflow Management System which tasks were running in a defined time period. This information can help to identify a task which should be optimized the most. Optimizing of this specific task could have a large effect on overall performance. This information would be also helpful in resource planning.

Using ad-hoc queries are useful for managers because of results of the queries inform them about current states.

Companies have also specific processes which are used to manage resources (for example recruitment and training processes). These specific processes could be automated because of defining a specific query on audit data.

Most of the logs are XML-based, all WfM engines record similar audit information. We could use XML for Analysis (industry standard for data access in analytical systems, such as OLAP and Data Mining) and MDX (query language for OLAP databases) to implement OLAP using data from audit created by running Workflow Management System.

6 COMBINING WORKFLOW STRUCTURE AND WORKFLOW AUDIT DATA

Process definition contains information about structure of the process, but it is not mentioned information about actual performing processes in process definition. This kind of information could be captured by running WfMS and could be saved as audit logs.

Information about real frequency of task or process and task sequence (directly captured by running WFMS) in combination with structure of the process provide knowledge about the frequency of particular branches of workflow. It is also possible to see frequency of differences from projected performing.

This information would be helpful in resource planning. We can determine ratio of particular resources in case of average process performing.

It would be also very helpful if information about frequency of branches would be displayed directly in Process Definition Tool. This kind of information would be valuable for simulations or updating process definition, because we can simulate nearly the real behavior directly on process model. If a part of process is changed, at least we will know the frequency of preceding branches.

It would be also useful to have information about sequences of activity which appears very frequently. It would be possible to make a special resource which would be optimized just for these sequences of activities. Creating these specific resources means costs, but it can enormously increase throughput of the whole system.

7 CONCLUSION

The purpose of this article was to show contribution Workflow Management System to business process analysis. There was mentioned possibility of using OLAP on audit data which were created by Workflow Management System. It was also described supporting Process Design phase by information extracted from WfMS audit data.

REFERENCES

[1] Aalst van der,W.,Hee van, K.: Workflow management – Models, Methods, and Systems, The MIT Press Massachusetts 2004, 368 p., ISBN 0-262-72046-9

[2] Workflow Management Coalition – The Workflow Reference Model, United Kingdom 1995

[3] Workflow Management Coalition – Terminology & Glossary, United Kingdom 1999

[4] David Hollingsworth, Fujitsu Services, United Kingdom Chair, Technical Committee, WfMC – The Workflow Reference Model 10 Years On, United Kingdom 2003

[5] Cichocki, A., et. al.: Workflow and process automation: Concepts and Technology, Kluwer academic Publisher, Dordrecht, 1998, 117 p.

[6] Marlon, D., Aalst van der,W., Hoftstede, A.: Process-aware infromation systems, JOHN WILEY & SONS, INC, New Jersey 2005, 432 p., ISBN: 978-0-471-66306-5

[7] Wegrzyn A., Karatkevich, A., Bieganowski, J. : Detection of deadlocks and traps in Petri Nets by means of Thelen's prime implicant method, Appl. Math. Comput. Sci., 2004, Vol. 14, No. 1, 113–121

[8] Dijkman, Remco M., Dumas, M., Ouyang, Ch.: Formal Semantics and Automated Analysis of BPMN Process Models

[9] Störrle H.: An Evaluation of High-End Tools for Petri-Nets, Ludwig-Maximilians-Universität München 1998, 42 p.