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Re-engineering knock-out processes

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Abstract

The core of many workflow processes in banks, insurance companies, governmental departments, and administrations of multinationals is formed by a set of tasks that are used to classify cases into two groups: accepted and rejected. Each of these tasks has two possible outcomes: OK or NOK (i.e., Not OK). If for a specific case all tasks result in OK, the case is accepted, otherwise it is rejected. In this paper, we concentrate on the order in which these tasks need to be executed to yield an 'optimal' process with respect to the utilization of resources and flow time. Both sequential and parallel routing are considered. The effect of combining tasks is also investigated. A step-wise approach consisting of 11 concrete re-engineering rules is given. The approach is supported by a simulation toolbox ExSpect/KO. © 2001 Elsevier Science B.V. All rights reserved.

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1.Introduction

Today's successful corporations consider the business processes to be the crown jewels of the organization and are constantly challenged to improve the performance and efficiency of these processes. There are several reasons for the increased interest in business processes. First of all, management philosophies such as Business Process Re-engineering (BPR) and Continuous Process Improvement (CPI) stimulated organizations to become more aware of their business processes. Secondly, today's organizations need to deliver a broad range of products and services. As a result, the number of processes inside organizations has increased. Consider, for example, mortgage loans. A decade ago, there were just a few types of mortgages, at the moment numerous types are available. Not only the number of products and services has increased, also the lifetime of products and services has decreased in the last three decades. As a result, today's business processes are also subject to frequent changes. Moreover, the complexity of these processes increased considerably. Finally, today there are generic tools such as Workflow Management (WFM) and Enterprise Resource Planning (ERP) systems, which allow for the definition, execution, registration, and control of workflow processes. These tools have triggered many organizations to rethink their business processes.

The increased interest in business processes, in particular the re-engineering of workflow processes, has uncovered the Achilles' heel of business process management: the lack of concrete quantitative guidelines for the design of processes in the service

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industry (i.e., banks, insurance companies, and administrations). Existing approaches are either not applicable by end-users or focus on qualitative aspects. *Queuing theory* [26], in particular the analysis of queuing networks [16,18], provides many results and has been applied in the domain of (flexible) manufacturing systems [12], computer networks [10], and telecommunication systems [35]. However, the results described in literature are only applicable to specific situations, require advanced tools, and do not provide concrete guidelines for re-engineering. Nevertheless, it is clear that queuing theory could provide a firm theoretical basis for re-engineering efforts. *Simulation* is a very flexible technique. Modern simulation packages allow for both the visualization and performance analysis of a given process [6,22]. Unfortunately, it takes a lot of time to build a simulation model, accurate interpretation of simulation results requires statistical knowledge, and simulation only supports 'what–if analysis', i.e., it does not suggest improvements. Literature on BPR [1,15, 20,21,24,29,30,32] and WFM [19,23,25,27,28,37] focuses on the organizational and technical aspects rather than formulating quantitative rules for re-engineering. For example, the 36 'process improvement rules' provided by Poyssick and Hannaford in Ref. [32] are of a qualitative nature and do not give any concrete support for the design of the control of a given business process. The paper by Buzacott [11] is one of the few papers targeting at quantitative redesign rules for business processes.

In this paper, we focus on the re-engineering of *knock-out processes*. For this type of process, we try to bridge the gap between queuing theory and simulation on the one hand and qualitative approaches on the other hand. A knock-out process is a workflow process with a specific structure [4]. As any workflow, a knock-out process is *case-based*, i.e., every piece of work is executed for a specific *case*. Examples of cases are a mortgage, an insurance claim, a tax declaration, an order, or a request for information. Cases are often generated by an external customer. However, it is also possible that a case is generated by another department within the same organization (internal customer). The goal of a knock-out process is to decide whether the case should be accepted or rejected. To make this decision, a number of tasks need to be executed. Each task has two possible results: OK or NOK (i.e., not OK). If for a specific case a task results in NOK, the case is rejected immediately. Only if all tasks have a positive result, the case is accepted. Many workflow processes have parts, which can be considered to be knock-out processes. Handling an insurance claim, a request for a loan, a job application, and the reviewing of paper for publication in a journal are typical examples of processes with a knock-out structure. This paper provides a set of rules for the redesign of knock-out processes. The rules are easy to apply and do not require advanced tool support. However, the rules are heuristics and do not give decisive answers to all questions. Therefore, the approach presented in this paper is supported by the simulation toolbox *ExSpect / KO* specifically developed for the analysis of knock-out processes. The toolbox is implemented using the Petri-net-based simulation package ExSpect [8,9].

The paper is organized a follows. First, a formal definition of a so-called knock-out problem and the associated class of knock-out processes are given. Then, using a three-step approach, issues such as the ordering of tasks, the combining of tasks, and the parallel execution of tasks are addressed. Finally, the toolbox ExSpect/KO is described. To illustrate the approach, the process of handling a request for a mortgage is used throughout the paper.

2. Knock-out processes

A knock-out problem is a business situation where for each case a pre-specified set of tasks needs to be executed. As indicated in the introduction, the processing of a task stops immediately if in one of the tasks a reason for rejection is detected. Only cases that successfully pass all tasks are accepted. A knock-out problem consists of an arrival process (i.e., new cases), a set of tasks, a set of resource classes, and a set of precedence constraints. The arrival process is specified by the arrival rate, i.e., the average number of new cases that arrives each time unit. In this paper, we assume a Poisson arrival process [16,26]. Tasks are mapped onto *resource classes*, i.e., a task requires a resource of a specific resource class. Per resource class, the number of available resources is given. In a typical organization