Chapter 22

Business Process Control–Flow Complexity: Metric, Evaluation, and Validation

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ABSTRACT

Deliberate exploitation of natural resources and excessive use of environmentally abhorrent materials have resulted in environmental disruptions threatening the life support systems. A human centric approach of development has already damaged nature to a large extent. This has attracted the attention of environmental specialists and policy makers. It has also led to discussions at various national and international conventions. The objective of protecting natural resources cannot be achieved without the involvement of professionals from multidisciplinary areas. This chapter recommends a model for the creation of knowledge-based systems for natural resources management. Further, it describes making use of unique capabilities of remote sensing satellites for conserving natural resources and managing natural disasters. It is exclusively for the people who are not familiar with the technology and who are given the task of framing policies.

INTRODUCTION

Business process management systems (BPMS) (Smith & Fingar, 2003) provide a fundamental infrastructure to define and manage business processes. BPMS, such as Workflow Management Systems (WfMS) (Cardoso, Bostrom & Sheth, 2004), have become a serious competitive factor for many organizations that are increasingly faced with the challenge of managing e-business applications, workflows, Web services, and Web processes. Business processes, such as Web processes (WS-BEPL, 2005) promise to ease several current infrastructure challenges, such as data, application, and process integration. With the emergence of Web services, a workflow management system becomes essential to support, manage, and enact processes, both among enterprises
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and within the enterprise (Sheth, van der Aalst & Arpinar, 1999).

A vast amount of work done so far in the business process field has targeted the development of WFMS, including models (e.g., Petri nets), modeling languages (BPML, 2004; BPMN, 2005; Leymann, 2001; Menzel, Mayer, & Edwards, 1994; Singh, 1995; van der Aalst, 1998; van der Aalst & Hofstede, 2003), and execution environments (Alonso, Mohan, Guenthoer, Agrawal, El Abbadi, & Kamath, 1994; Canós, Penadés, & Carsi, 1999; Jablonski, 1994; Kochut, Sheth, & Miller, 1999; Miller, Palaniswami, Sheth, Kochut, & Singh, 1998; Wodtke, Weissenfels, Weikum, & Dittrich, 1996). Work has also been carried out to develop methods to analyze processes in order to verify their correctness, testing the existence of livelocks and deadlocks (van der Aalst, 1998).

Recently, a new field of research for processes has emerged. This new field—termed process measurement—presents a set of approaches to the quantification of specific properties of processes. Important properties to analyze include the estimation of complexity, defects, process size, effort of testing, effort of maintenance, understandability, time, resources, and quality of service. Process measurement is still in its infancy, and much work has yet to be undertaken.

The effective management of any process requires modeling, measurement, and quantification. Process measurement is concerned with deriving a numeric value for attributes of processes. Measures, such as Quality of Service measures (Cardoso, Miller, Sheth, Arnold, & Kochut, 2004), can be used to improve process productivity and quality.

Designing and improving processes is a key aspect in order for businesses to stay competitive in today’s marketplace. Organizations have been forced to improve their business processes because customers are demanding better products and services. When an organization adopts a process management philosophy, process improvement can take place. Independently of the approach taken, which can be a continuous process improvement (Harrington, 1993), a Business Process Redesign (Wastell, White, & Kawalek, 1994), or a Business Process Reengineering (Ould, 1995) approach, methods need to be available to analyze the processes undergoing improvements. To achieve an effective management, one fundamental area of research that needs to be explored is the complexity analysis of processes.

A business process is composed of a set of activities, tasks, or services put together to achieve a final goal. As the complexity of a process increases, it can lead to poor quality and be difficult to reengineer. High complexity in a process may result in limited understandability and more errors, defects, and exceptions, leading processes to need more time to develop, test, and maintain. For example, in software engineering, it has been found that program modules with high-complexity indices have a higher frequency of failures (Lanning & Khoshgoftaar, 1994). Therefore, excessive complexity should be avoided. For instance, critical processes in which failure can result in the loss of human life require a unique approach to development, implementation, and management. For these types of processes, typically found in healthcare applications (Anyanwu, Sheth, Cardoso, Miller, & Kochut, 2003), the consequences of failure are severe. The ability to produce processes of higher quality and less complexity is a matter of endurance.

Surprisingly, in spite of the fact that there is a vast amount of literature on software measurement of complexity (Zuse, 1997), no significant research on process measurement of complexity has yet been carried out. Analyzing the complexity at all stages of process design and development helps avoid the drawbacks associated with high-complexity processes. Currently, organizations have not adopted complexity metrics as part of their process management projects. As a result, simple processes may be designed in a complex way.