Chapter 28

Advanced Branching and Synchronization Patterns Description Using Pi–Calculus

Kui Yu  
Yunnan University, China

Nan Zhang  
Yunnan University, China

Gang Xue  
Yunnan University, China

Shaowen Yao  
Yunnan University, China

ABSTRACT

Workflow patterns contain basic features of business process. Advanced branching and synchronization patterns present a series of patterns, which characterize more complex branching and merging concepts which arise in business processes. Pi-calculus can be applied in business process modeling. In this chapter, this kind of workflow patterns is investigated using Pi-calculus.

1 INTRODUCTION

The Workflow Patterns Initiative was established with the aim of delineating the fundamental requirements that arise during business process modeling on a recurring basis and describe them in an imperative way (Russell N. A., 2006). There are eight kinds of the workflow patterns, the kind of the most patterns of which is Advanced Branching and Synchronization Patterns. Advanced Branching and Synchronization Patterns presents a series of patterns which characterize more complex branching and merging concepts which arise in business processes (Van Der Aalst, 2003).

Mobile systems are made up of components that communicate and change their structure as a result of communication (Puhlmann F. a., 2005). The Pi-calculus is a process algebra that describes mobile systems. Based on the execution semantics...
of the Pi-calculus, the behavior of each workflow pattern has been defined precisely in (Puhlmann F. a., 2005). This paper introduces Advanced Branching and Synchronization Patterns formalizations, each with an unambiguous formal definition and execution semantics (Puhlmann F. a., 2005).

The paper is organized as follows: Section 2 discusses related work. Section 3 includes brief introduction to Advanced Branching and Synchronization Patterns and Pi-calculus. Patterns are described using Pi-calculus in section 4. In section 5, description checking sample is shown. In section 6, this paper is concluded with an outlook and directions for future work.

2 BACKGROUND

2.1 Related Work

A Ph.D. thesis by Twan Basten researches basic process algebra and Petri nets (Basten, 1998). A more practical approach of using CCS (Milner R., 1999) to formalize web service choreography can be found in (Brogi A. C., 2004). Another approach of giving a detailed representation of the workflow patterns has been made with YAWL (van der Aalst W. t., 2003). The only approach known to the authors on the use of the Pi-calculus for workflow definitions is from Yang Dong and Zhang Shen-Sheng and centers on basic control flow constructs and the definition of activities (Dong & Dadam, 2003). Pi-calculus and Petri nets provide theoretical support for most business process standard (Gang Xue, 2008). Recently, Pi-calculus is also used to formalize web service interactions. Reference (Decker G. F., 2006) describes and formalizes web services using Pi-calculus, and the model described has been verified (Decker G. F., 2006).

2.2 Advanced Branching and Synchronization Patterns

The Workflow Patterns Initiative was established with the aim of delineating the fundamental requirements that arise during business process modeling on a recurring basis and describe them in an imperative way. There are eight kinds of the workflow patterns. They are as follows (Russell N. A., 2006): Basic Control Flow Patterns, Advanced Branching and Synchronization Patterns, Multiple Instance Patterns, State-based Patterns, Cancellation and Force Completion Patterns, Iteration Patterns, Termination Patterns, Trigger Patterns. Advanced Branching and Synchronization Patterns presents a series of patterns which characterize more complex branching and merging concepts which arise in business processes. This kind of patterns contains the most pattern and changes in various forms. This paper is mainly used to describe the kind of Advanced Branching and Synchronization Patterns using Pi-calculus.

2.3 Pi-Calculus

The Pi-calculus is a modern process algebra that describes mobile systems in a broader sense (Milner R. J., 1990). We give a brief presentation of the syntax and semantics of the Pi-calculus in this section. The syntax of Pi-calculus is given below by the following equation (Milner R. J., 1990).

\[ P ::= 0 \]
\[ \overline{x}y.P \]
\[ |x(y).P \]
\[ \tau.P \]
\[ (x)P \]