Transforming XPDL to Petri Nets

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Abstract. As a textual specification for process definition, XPDL lacks formal semantics which hinders the formal analysis and verification of business processes. In this paper, we provide a method for translating XPDL processes into Petri nets for the formal analysis of XPDL processes. The algorithm validity has been proved, and has also been verified by experiments on artificial and practical processes.

1 Introduction

The XML Process Definition Language (XPDL) is a formal standard process definition language proposed by the Workflow Management Coalition (WfMC) \cite{14}. The purpose is to serve as an exchange language between different modeling languages. Today there are over 50 major business process management and application vendors that support the XPDL standard, including IBM, Oracle, BEA, Fujitsu, Tibco, and Global 360 \cite{8}. However, As a textual specification of process definition, XPDL lacks formal semantics which serves as the foundation of formal analysis and computer aided verification.

To analyze process models without formal semantics, usually we can first transform them into formal models. A lot of such efforts have been dedicated to analyze BPEL, e.g., to finite state machines \cite{4,5}, to process algebra \cite{3}, to Petri nets \cite{11,6}, and our former work to OWL-S \cite{10}, etc. And a Petri net is a rather desirable target language of such transformation, with its formal semantics and the availability of many analysis techniques and tools \cite{1}.

Although XPDL is a competitive standard to BPEL, no attempts on transforming XPDL have been published so far. In this paper, we present a mapping method from XPDL to Petri nets. For each XPDL process model, we can get a Petri net with equivalent structure and behaviors. The Petri net can be exported to a PNML \cite{13} file for further analysis or simulation purposes.

The remainder of this paper is organized as follows. Section \textsuperscript{2} gives a brief overview on XPDL and process meta-model. Section \textsuperscript{3} presents a mapping semantics between XPDL and Petri nets. Section \textsuperscript{4} presents the algorithm step...
by step and its validity proof. Section 5 gives case study details. Section 6 discusses the related work and our contributions. Section 7 concludes the paper and discusses future work.

2 A Brief Introduction to XPDL

The WfMC has identified five functional interfaces to a workflow service as part of its standardization program. XDPL forms part of the documentation relating to Interface one - supporting process definition import and export. XPDL is a common meta-model for describing the process definition. The purpose is to serve as an interchange of process definition between different tools and also different vendors. The first version of a standard interchange language was the Workflow Process Definition Language (WPDL), published by the WfMC in 1998. The growing popularity of XML and its use for defining document formats for the Internet, combined with some years of accumulated experience using WPDL in workflow and BPM tools, led to the creation of XPDL 1.0, which was officially released in 2002. XPDL retained the semantics of WPDL but defined a new syntax using an XML schema. Neither WPDL nor XPDL 1.0 proposed a specific graphical representation. Intended to be used as a file format for Business Process Modeling Notation (BPMN), XPDL 2.0 was published in 2005, which is back compatible with XPDL 1.0 [9].

Figure 1 is an XPDL process meta-model that describes the top-level entities contained within a process definition, with their relationships and attributes. We have skipped XPDL package meta-model, for XPDL package is just a container for XPDL processes. For more details of XPDL meta-model, we can refer to [14].

Currently dozens of vendors have announced conformance of XPDL. A more detailed list of vendors and products can be found on the WfMC website.

3 Mapping from XPDL to Petri Nets

Our goal is to translate an XPDL process model into a Petri net. However, we do not pursue a complete Petri net semantics to XPDL. We focus on structure and behavior equivalence. As shown in Figure 2, a process meta-model includes several elements, e.g., activities, participants, applications, transitions and data fields, etc. We skip some elements which are not related to our concerns, e.g., applications, data fields and other extended attributes of various tool vendors, etc. In this section, we introduce the mapping semantics in three aspects, namely, activities, links and routing structures.

3.1 Activities

An XPDL activity can have attributes and child elements, such as Id, Name, Performer, and Join/Split type, etc. An activity is either primitive or structured.

\[1 \text{http://www.wfmc.org/standards/conformance_chart.htm}\]