A Survey of Comparative Business Process Modeling Approaches

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Abstract. There has been a huge influx of business process modeling langu
ages as business process management (BPM) and process-aware information
systems continue to expand into various business domains. The origins of pro-
cess modeling languages are quite diverse, although two dominant approaches
can be observed; one based on graphical models, and the other based on rule
specifications. However, at this time, there is no report in literature that specifi-
cally targets a comparative analysis of these two approaches, on aspects such as
the relative areas of application, power of expression, and limitations. In this
paper we have attempted to address this question. We will present both a survey
of the two approaches as well as a critical and comparative analysis.

Keywords: business process management, workflows, business process
modeling and analysis, rule-based workflows, graph-based workflows.

1   Introduction

Business process management (BPM) solutions have been prevalent in both industry
products and academic prototypes since the late 1990s. It has been long established
that automation of specific functions of enterprises will not provide the productivity
gains for businesses unless support is provided for overall business process control
and monitoring. Business process modeling is the first and most important step in
BPM lifecycle [5], which intends to separate process logic from application logic,
such that the underlying business process can be automated [32]. Typically, process
logic is implemented and managed through a business process management system
(BPMS) and application logic through underlying application components.

Business process modeling is a complicated process and it is obvious that different
modeling approaches have their strengths and weaknesses in different aspects due to
the variety of their underlying formalisms. There are many well-known problems
regarding process modeling methodologies, such as the classic tradeoff between
expressibility of the modeling language and complexity of model checking. Some
languages offer richer syntax sufficient to express most relevant business activities
and their relationships in the process model, while some provide more generic

modeling constructs which facilitate efficient verification of the process model at design time. These have been prevalent in research prototypes (e.g., FlowMake [30], ADEPT$_{flex}$ [29], YAWL [3]), in commercial products (e.g., Tibco Staffware Process Suite [34], Oracle BPEL Process Manager [28], ILOG BPM [15]), as well as in industrial standard modeling languages (BPEL4WS [26], BPMN [27]).

Among the huge options of modeling languages, there have been methodical investigations in literature that attempt to address a variety of issues. These investigations involve a number of comparison techniques. First, in [33], an **empirical study** on process modeling success in industry is presented, where success factors of process modeling are generalized from multiple case studies of industry applications and the measure for effective process modeling is derived. Second, **ontological comparison** techniques utilize the semantic richness of an appropriate ontology as the benchmark for comparing process modeling languages. In [12], the interoperability of a business process specification (in particular, ebXML) is studied through a mapping from constructs in Bunge-Wand-Weber (BWW) ontology model to constructs in ebXML. Lastly, [20] presents a framework for selecting appropriate process modeling tools based on the **heuristics** collected from process modeling and business domain experts. The heuristics is used to provide quantifiable measure for indicating preferences on modeling tools selection.

We have conducted a study on the comparative business process modeling languages [23] based on a different comparison criteria. The scope of the comparison is on the most critical dimension of business process models, namely **control flow** perspective [30], from a selection of modeling approaches based on different theoretical foundations. The two most dominant foundations can be found in models bases on graphs and rules. The goal of comparison is to investigate, through the language representatives, the strengths and limitations of different theoretical foundations when being applied in business process modeling.

The focus of this paper is to summarize the comparison results and critical remarks reported in [23], and to facilitate future investigations and developments on business process modeling. In what follows, a survey of business process modeling approaches is first presented in section 2 to provide insights into current process modeling practices, based on which the comparison methodology is discussed in section 3. The comparison results, along with critical remarks are presented in section 4. Process modeling techniques in current commercial BPMS products are also briefly discussed in section 5 to present industry developments and trends. We conclude this paper and discuss possible future work in section 6.

2   A Survey on Business Process Modeling Approaches

The objective of process modeling is to provide high-level specification independent from the implementation of such specification. In this paper, we use the following definition for process modeling languages: A **process modeling language** provides appropriate syntax and semantics to precisely specify business process requirements, in order to support automated process verification, validation, simulation and process