Towards a Taxonomy of Process Flexibility

M.H. Schonenberg, R.S. Mans, N.C. Russell, N.A. Mulyar
and W.M.P. van der Aalst

Eindhoven University of Technology
P.O. Box 513, 5600 MB Eindhoven, The Netherlands
{m.h.schonenberg,r.s.mans,n.c.russell,nmulyar,w.m.p.v.d.aalst}@tue.nl

Abstract. Effective business processes must be able to accommodate changes in the environment in which they operate. Many approaches have been proposed in literature and some of these approaches have been implemented in flexible workflow management systems. However, a comprehensive classification of the various approaches has been missing. In this paper, we take a first step towards a taxonomy of process flexibility by distinguishing four types of process flexibility based on an extensive literature study. An evaluation shows that each of the types can be found in contemporary offerings.
Keywords: taxonomy, flexibility, design, change, deviation, underspecification

1 Introduction

The need for process flexibility has long been recognised [8, 15] in the workflow and process technology communities as a critical quality of effective business processes to adapt to changing business circumstances, e.g., new business strategies. The notion of flexibility is often viewed in terms of the ability of an organisation's processes and supporting technologies to adapt to these changes [7, 16]. Others [12] consider flexibility from the opposite perspective, i.e., they focus on the part of the process which remain unchanged, rather than focusing on which parts have to be changed. Indeed, a process can only be considered to be flexible if it is possible to change it without needing to replace it completely [13].

There have been a series of proposals for classifying flexibility [2, 6, 8, 13], both in terms of the factors which motivate it and the ways in which it can be achieved within business processes. The individual flexibility types discussed in this paper are informed by a multitude of research initiatives in the workflow and BPM fields. Nevertheless, a comprehensive overview of distinct approaches has been missing.

Based on an extensive literature study [9], in Section 2 we identify four distinct types of process flexibility that improve the ability of business processes to respond to changes in their operating environment without necessitating a complete redesign of the underlying process specification. Then in Section 3, we explore the support of the flexibility types and show that each of them exists in contemporary offerings. Finally, the conclusion and future work are presented in Section 4.

2 Flexibility types

First, we present four distinct types of process flexibility and describe how each of the flexibility types operates [9].

Flexibility by design: for handling anticipated changes in the operating environment, where supporting strategies can be defined at design-time.
Flexibility by deviation: for handling occasional unforeseen behaviour, where differences with the expected behaviour are minimal.
Flexibility by underspecification: for handling anticipated changes in the operating environment, where strategies cannot be defined at design-time, because the final strategy is not known in advance or is not generally applicable.
Flexibility by change: either for handling occasional unforeseen behaviour, where differences require process adaptations, or for handling permanent unforeseen behaviour.

Figure 1 illustrates the distinction between the flexibility types in isolation, in terms of the time at which the specific flexibility options need to be configured (1) at design-time, as part of the process definition, or (2) at run-time via facilities in the process execution environment. It also shows the relative completeness of the process definition for each flexibility type at run-time.

Flexibility by underspecification works on the basis of an incomplete process definition. Combined with late binding only, it just offers design-time configuration options, i.e., only the fragments that have been defined during design-time can be selected at run-time. However, when combined with late modelling, also run-time configuration options are offered by providing means to define and select fragments at run-time. In the spectrum of options, *flexibility by design* distinguishes itself by being the flexibility type that is only configurable at design-time, i.e., at design-time the set of possible execution paths is fixed. Hence increasing flexibility corresponds to making this set bigger. Both *flexibility by deviation* and *change* work with complete process definitions. For both types, the configuration options are only available at run-time. Although very similar, only flexibility by change affects the process definition both at instance and type level, whereas flexibility by deviation does not affect the process definition at all, i.e., the model and the reality no longer match after deviation.

3 Evaluation of Contemporary Offerings

To validate the flexibility types, we investigate the degree of support of them in different Process Aware Information Systems (PAISs) [9]. We consider ADEPT1 [14], YAWL[1] (version 8.2b) [1, 4, 5], FLOWer (version 3.0) [3] and DECLARE (version 1.0) [10,11]. The selection of these PAISs has been based on the criterion of supporting process flexibility, which excludes classical workflow systems and

[1] The evaluation of YAWL includes the so-called Worklet Service [4, 5].

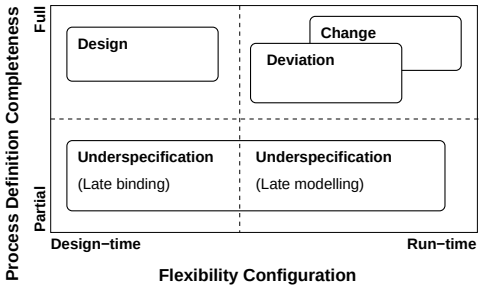

Fig. 1. Flexibility type spectrum

Flexibility by	ADEPT1	YAWL	FLOWer	DECLARE
design	+	+	+	+
deviation	−	−	+	+
underspecification	−	+	−	−
change	+	−	−	+

Fig. 2. Evaluation results

most commercial systems. Moreover, the selected systems cover distinct areas of the PAIS technology spectrum, such as adaptive workflow (ADEPT1), case handling (FLOWer) and declarative workflow (DECLARE).

The evaluation results are summarized in Figure 2, which shows whether the PAIS supports (+) or does not support (–) the respective flexibility type. A detailed evaluation can be found in [9]. None of the evaluated systems provides the full range of flexibility alternatives. Flexibility by design is (to some degree) supported by all offerings. YAWL excels in flexibility by underspecification, ADEPT1 in flexibility by change, FLOWer in flexibility by deviation and DECLARE excels in two areas, namely deviation and change.

4 Conclusion

In this paper we have identified four distinct types of process flexibility. These types are based on a wide variety of proposals for process flexibility found in literature and in practice. The distinction is based on the flexibility configuration (i.e., design-time vs. run-time), the completeness of the process definition and whether it be done without changing the process definition, or not. Our evaluation shows that each of the types exists in contemporary offerings. Interestingly, none of these offerings supports all flexibility types. As future work, we plan to formalise the identified flexibility types in a taxonomy of process flexibility.

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