Manfred Reichert, Barbara Weber

Enabling Flexibility in Process-Aware Information Systems

Challenges, Methods, Technologies

March 29, 2012

Springer

(c) Springer-Verlag, Berlin Heidelberg, 2012 BOOK PREVIEW

(c) Springer-Verlag, Berlin Heidelberg, 2012 BOOK PREVIEW

Contents

(c) Springer-Verlag, Berlin Heidelberg, 2012 BOOK PREVIEW

(c) Springer-Verlag, Berlin Heidelberg, 2012 BOOK PREVIEW

(c) Springer-Verlag, Berlin Heidelberg, 2012 BOOK PREVIEW

(c) Springer-Verlag, Berlin Heidelberg, 2012 BOOK PREVIEW

(c) Springer-Verlag, Berlin Heidelberg, 2012 BOOK PREVIEW

(c) Springer-Verlag, Berlin Heidelberg, 2012 BOOK PREVIEW

(c) Springer-Verlag, Berlin Heidelberg, 2012 BOOK PREVIEW

(c) Springer-Verlag, Berlin Heidelberg, 2012 BOOK PREVIEW

(c) Springer-Verlag, Berlin Heidelberg, 2012 BOOK PREVIEW

Chapter 3
Flexibility Issues in Process-Aware Information Systems

Abstract Traditionally, process-ware information systems (PAISs) have focused on the support of predictable and repetitive business processes. Even though respective processes are suited to be fully pre-specified in a process model, flexibility is required to support dynamic process adaptations in case of exceptions. Flexibility is also needed to accommodate the need for evolving business processes and to cope with business process variability. Furthermore, PAISs are increasingly used to support less structured processes which can often be characterized as knowledge-intensive. Processes of this category are neither fully predictable nor repetitive, and therefore cannot be fully pre-specified at build-time. The (partial) unpredictability of these processes also demands a certain amount of looseness. This chapter deals with the flexibility needs of both pre-specified and loosely-specified processes and elicitates requirements for flexible process support in a PAIS. In addition, the chapter discusses PAIS features needed to accommodate flexibility needs in practice like, for example, traceability, business compliance and user support.

3.1 Motivation

Traditionally, PAISs have focused on the support of predictable and repetitive business processes, which can be fully described prior to their execution in terms of formal process models [179]. Typical examples falling in this category include business processes in banking and insurance companies; e.g., opening a new bank account or granting a loan. Even though repetitive business processes are usually predictable, a certain degree of flexibility is needed to support dynamic process adaptations in case of exceptions; e.g., death of a policyholder or a marital divorce requiring a change of insurance and/or beneficiaries [337]. Moreover, flexibility is required to accommodate the need for evolving business processes. As example consider process changes due to altered legal requirements. Finally, support for business process variability is needed. For example, different process variants may exist depending on the type of insurances.

(c) Springer-Verlag, Berlin Heidelberg, 2012 BOOK PREVIEW

PAISs are increasingly used to support less structured business processes as well. The latter are often characterized as *knowledge-intensive*. Processes of this category feature *non-repeatability*, i.e., the models of two process instances do not fully resemble one another. Generally, knowledge-intensive processes tend to be *unpredictable* since the exact course of action depends on situation-specific parameters [337]. The values of these parameters are usually not known *a priori* and may change during process execution. Moreover, knowledge-intensive processes can be characterized as *emergent*, i.e., knowledge gathered during the execution of the process determines its future course of action [141]. Consequently, respective processes cannot be prescribed at a fine-grained level at build-time. In addition to variability, adaptation and evolution that is required for predictable processes, they require looseness. Typical examples of the latter process category include innovation processes (e.g., introducing a new product or service) and call center processes (e.g., handling of a computer problem by the helpdesk).

The vast majority of business processes, however, can be characterized by a combination of predictable and unpredictable elements falling in between these two extremes. Healthcare processes, for example, reflect the combination of predictable and unpredictable elements quite well. While procedures for handling single medical orders or examinations are relatively predictable, complex patient treatment processes are rather unpredictable and unfold during process execution [173]. Similar considerations hold for law enforcement processes (i.e., investigation of a crime) [337]. A criminal investigation constitutes an example of a knowledge-intensive process that can be characterized by non-repeatability, unpredictability, and emergence. However, this process has predictable elements as well; e.g., lab analysis or witness deposition.

Providing appropriate support for this wide range of business processes poses several challenges, which will be detailed in this chapter. In Section 3.2 we elaborate in detail on the different flexibility needs. Once these are identified, Section 3.3 elicitates fundamental requirements for flexible business process support by a PAIS. Finally, Section 3.4 discusses the organization of the remaining book chapters along the identified flexibility needs.

3.2 A Taxonomy of Flexibility Needs in Process-aware Information Systems

Flexible process support by a PAIS can be characterized by four major flexibility needs, namely support for variability, looseness, adaptation, and evolution (cf. Fig. 3.1). Each of these flexibility needs may affect each of the process perspectives (i.e., behavior, organization, information, operation, function, and time) introduced in Chapter 2. In the subsequent sections of this chapter we present a brief summary of each flexibility need and present real-world processes to illustrate it. A detailed discussion of concepts and methods satisfying these needs follows in the remaining book chapters.

(c) Springer-Verlag, Berlin Heidelberg, 2012 BOOK PREVIEW

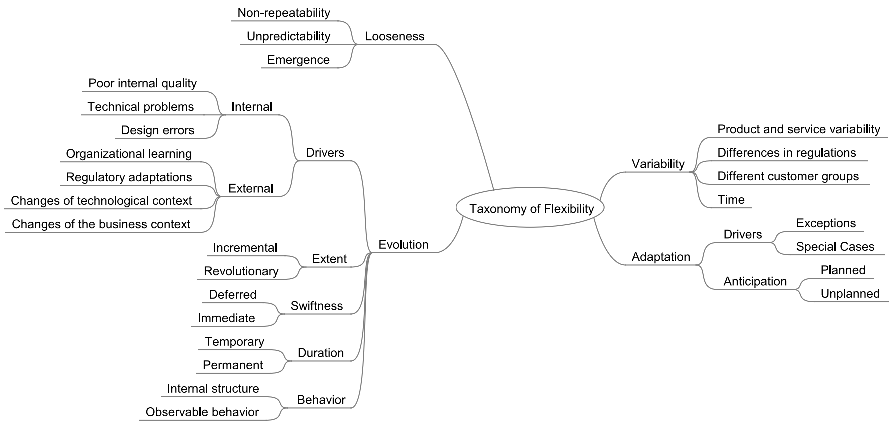

Fig. 3.1 A Taxonomy of Process Flexibility Needs

3.2.1 Variability

Process variability can be found in many domains and requires processes to be handled differently—resulting in different *process variants*—depending on the given context [107, 125, 130]. Process variants typically share the same core process whereas the concrete course of action fluctuates from variant to variant. *Product and service variability*, for example, often require support for different process variants depending on the concrete product variant [227]. Moreover, process variants might exist due to *differences in regulations* found in different countries and regions [129]. Variability might be also introduced due to different *groups of customers* (e.g., priority care for premium customers) or due to *temporal differences* (e.g., seasonal changes). The parameters causing process variability are mostly known *a priori* (e.g., country-specific regulations). Even though the concrete variant can often only be determined during process execution, the course of action for a particular context is well understood.

Example 3.1 (Vehicle Repair). The process for handling vehicle repair in a garage constitutes a good example of a process showing high variability. Depending on the process context, different variants of this process are required. While some parts of the process are shared by all variants, variability is introduced due to country-specific, garage-specific, and vehicle-specific differences. Overall, hundreds of variants may exist in such a context [129].

(c) Springer-Verlag, Berlin Heidelberg, 2012 BOOK PREVIEW

3.2.2 Looseness

As discussed, knowledge-intensive processes can be characterized as *non-repeatable* (i.e., every process instance looks slightly different), *unpredictable* (i.e., the exact course of action is unknown and is highly situation-specific), and *emergent* (i.e., the exact course of action only emerges during process execution when more information becomes available). For processes of this category only their goal is known *a priori* (e.g., treating the rupture of a patient's cruciate ligament or the judical process in seeking a criminal conviction). In turn, the parameters determining the exact course of action are typically not known *a priori* and might change during process execution. As a consequence, these processes cannot be fully pre-specified. In addition, it is not possible to establish a set of process variants for these processes, since the parameters causing differences between process instances are not known *a priori* (unlike with variability). Instead, processes of this category require a loose specification.

Example 3.2 (Patient Treatment Processes). Patient treatment processes in a hospital typically comprise activities related to patient intake, admission, diagnosis, treatment, and discharge [173]. Typically, such processes comprise dozens up to hundreds of activities and are long-running (i.e., from a few days to several months). Furthermore, the treatments of two different patients are *rarely identical*; instead the course of action greatly depends on the specific situation; e.g., health status of the patient, allergies and chemical intolerances, decisions made by the physician, examination results, and clinical indications. This situation can change during the treatment process, i.e., the course of action is *unpredictable*. Moreover, treatment processes typically unfold during their execution, i.e., examination results yield information determining how to continue with the treatment. The overall treatment process thereby emerges through the arrangement of simple, well structured processes (e.g., handling medical orders) often resulting in complex process structures.

3.2.3 Adaptation

Adaptation represents the ability of a PAIS to adapt the process and its structure (i.e., pre-specified model) to emerging events. Respective events often lead to situations in which the PAIS does not adequately reflect the real-world process anymore. As a consequence, one or several process instances have to be adapted in order to realign the computerized processes with the real-world ones.

(c) Springer-Verlag, Berlin Heidelberg, 2012 BOOK PREVIEW

Drivers for Adaptation. Process adaptations are triggered by different drivers. Respective adaptations might be required to cope with *special situations* during process execution, which have not been foreseen in the process model [335], e.g., because they only occur very rarely. Moreover, *exceptions* occurring in the real-world (e.g., an allergic reaction of a patient) or processing errors (e.g., a failed activity) often require deviations from the standard process. A detailed discussion of sources for exceptions will follow in Chapter 6.

Anticipation of Adaptation. Usually, many exceptions can be anticipated and therefore be *planned* upfront by capturing them in the process model. Generally, a deviation can only be planned if both the context of its occurrence and measures to handle it are known. However, it is hardly possible to foresee all exceptions that may occur in the context of a particular process. Therefore, support for dealing with *unplanned* exceptions is additionally needed.

Example 3.3 (Examination Procedures in a Hospital). A simple examination procedure in a hospital comprises activities like *Enter Order*, *Schedule Examination*, *Inform Patient*, *Transfer Patient*, *Perform Medical Examination*, *Medical Report*, and *Validate Report* (cf. Example 2.2 in Chapter 2). Even for such a simple process, exceptional situations might occur, that require deviations from the pre-specified process. For example, in case of an emergency there is no time to follow the usual procedure. Instead the patient is immediately examined without making any appointment or preparing the examination facility. To cope with such situation, it should be possible to skip one or more activities. In exceptional situations it can further be required to perform additional (i.e., unplanned) activities for a particular patient (e.g., to carry out an additional preparation step for the examination). Besides changes in appointments, cancellations, failures in the execution of activities (e.g., omitted preparations, loss of a sample, or incorrect collection of diagnostic material) might also lead to deviations from the standard procedure (e.g., by redoing activities). If an appointment is cancelled, for example, the patient treatment process (including the previously made appointment) will have to be aborted.

In the medical domain such deviations from the standard procedure are the norm and have to be flexibly addressed by physicians and nursing staff.

(c) Springer-Verlag, Berlin Heidelberg, 2012 BOOK PREVIEW

3.2.4 Evolution

Evolution represents the ability of the process implemented in a PAIS to change when the corresponding business process evolves [62, 291]. Since business processes can evolve over time, it is not sufficient to implement them once and then to never touch the PAIS again. In order to ensure that real-world processes and the PAIS remain aligned, these changes have to be propagated to the PAIS as well. Typically, such evolutionary changes are planned changes at the process type level, which are conducted to accommodate evolving needs.

Drivers for Business Process Evolution. Process evolution is often driven by changes in the business, the technological environment, and the legal context [14]. Another driver is organizational learning. All these drivers are *external* to the PAIS (cf. Fig. 3.2). Evolution of real-world processes can be triggered by a changing *business context* like an evolving market (e.g., emergence of new competitors) or changing customer behavior. Changes in the *technological context* might have far reaching effects on the business processes of an organization. For example, the increasing popularity of mobile devices is revolutionizing the way how people are interacting with each other. Changes might further be triggered by *regulatory adaptations* like, for example, the introduction of Sarbanes-Oxley [339] or Basel II [43]. Finally, changes of business processes might be a result of *organizational learning* and be triggered by emerging optimization opportunities or misalignments between real-world processes and the ones supported by PAISs.

In addition to external triggers, changes of processes implemented in a PAIS might also become necessary due to developments inside the PAIS, i.e., there exist *internal* drivers for changes as well [14]. For example, *design errors* might cause problems during the execution of process instances in the PAIS (e.g., deadlocks or missing data). Moreover, *technical problems* like performance degradation (e.g., due to an increasing amount of data) may require changes in the PAIS. Finally, *poor internal quality* of process models (e.g., non intention revealing naming of activities or redundant process model fragments) may require changes [352].

Extent of Evolution. Process evolution may be *incremental* (i.e., only requiring small changes of the implemented process) as for continuous process improvements [138, 239, 242], or be *revolutionary* (i.e., requiring radical changes) as in the context of process innovation or process re-engineering [131].

Swiftness of Evolution. Depending on the kind of evolutionary change, different requirements regarding the treatment of ongoing process instances exist [255]. In some scenarios, it is sufficient to apply the changes only to those process instances which will be newly created and to complete the ongoing ones according to the old version of the business process. This, in turn, would require *deferred evolution* and co-existence of different versions of a process model within the PAIS. In many practical scenarios, however, evolutionary changes have an effect on ongoing process instances as well. For example, regulatory changes often have a retroactive

(c) Springer-Verlag, Berlin Heidelberg, 2012 BOOK PREVIEW

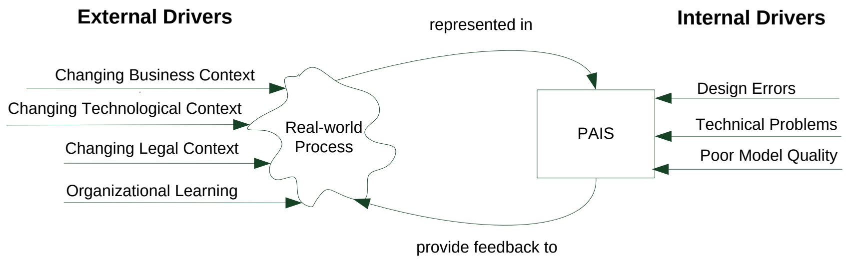

Fig. 3.2 Real-world Versus Computerized Processes

impact and require ongoing process instances (if they have not progressed too far) to be adapted. Such *immediate evolution* is mostly relevant for long-running processes instances, i.e., process instances with a duration up to several weeks or months.

Duration of Evolution. Evolutionary changes can be *permanent* or *temporary*. While *permanent changes* are valid from the time they are introduced (unless they are compensated by later permanent changes), *temporary changes* are only valid for a certain period of time, e.g., during a special promotion period.

Visibility of Evolution. Evolutionary changes may either be changes of the *observable process behavior* or the *internal structure* of the PAIS. While changes of the *observable behavior* are always reflected by the PAIS support of the real-world processes, changes of the *internal structure* are kept inside the PAIS (e.g., to address poor internal model quality) [352]. Adding or deleting activities from a process model are examples of changes concerning the observable behavior. A typical change only affecting the internal structure of the PAIS includes the removal of process model redundancies by extracting common parts to sub-process models.

Example 3.4 (Tender Preparation). A typical process for tender preparation comprises activities like *Enter Customer Request*, *Check Feasibility*, *Create Offer*, and *Submit Tender*. For *standard customers* the offer is usually created based on the latest price list, while for *gold customers* a special offer is prepared which has to be authorized by the department head. Since the creation of special offers (including checks of the special terms of the offer) turned out to be more expensive than estimated benefits (e.g., through increased customer loyalty), the management decided to evolve the process such that no special offers would be made in future.

In this example the evolution is triggered through organizational learning and economic concerns. The change is incremental and affects the external

(c) Springer-Verlag, Berlin Heidelberg, 2012 BOOK PREVIEW

behavior of the process in a permanent manner. Moreover, the change is deferred; i.e., it only affects newly created offers (i.e., future process instances).

Example 3.5 (Introduction of New Medical Devices). The introduction of new medical imaging devices in a hospital sometimes has implications on the corresponding examination process. Assume that due to the high acquisition cost for the new device the hospital decides to use it for examining outpatients as well (in addition to inpatient examinations). This, in turn, implies changes in the registration procedure. These changes not only affect new patients, but also ongoing examination processes.

In this example the evolution is triggered through economic concerns. As in Example 3.4 the change is incremental and affects the external behavior of the process in a permanent manner. Moreover, the change is immediate; i.e., it also affects ongoing examination processes.

Example 3.6 (Inconsistent Naming of Process Models). Large process model repositories that have evolved over many years often have significant inconsistencies regarding activity labels and labeling styles. For example, the repository described in [324] contained 16 process models all having activities dealing with the scheduling of medical procedures (e.g., surgeries, medical examinations and drug administrations). Though all these activities had similar intentions, different labels and labeling styles were used (e.g., “Make Appointment”, “Appointment”, “Schedule Examination”, “Fix Day”, “Agree on Surgery Date”, and “Plan”). This, in turn, required a huge effort when reusing the models later in the context of a large process model harmonization. In particular, activity labels had to be consolidated by refactoring respective process models [352].

3.3 Requirements for a Flexible PAIS

From the previously described flexibility needs (i.e., variability, looseness, adaptation, and evolution), technical requirements can be derived which have to be met by any PAIS supporting flexible processes (cf. Table 3.1). To enable process variability at a technical level, PAISs need to provide support for *configurable process models* and for the context-specific configuration of particular *process variants*. To accom-

(c) Springer-Verlag, Berlin Heidelberg, 2012 BOOK PREVIEW

modate the need for looseness, in turn, PAISs must provide support for *loosely-specified process models*, which do not require a completely pre-specified process model, but allow deferring modeling decisions to the run-time. Moreover, support for planned exceptions in terms of *exception handling support* as well as unplanned or unanticipated exceptions through the support of *ad-hoc changes* allowing for deviations from a pre-specified process model is needed. To adequately cope with business process evolution, PAISs require *versioning support for process models* (i.e., for deferred evolution) enabling the co-existence of different process model versions at the same time. Additionally, immediate evolution requires the *migration* of ongoing *process instances* to the new process model version. The problem of poor process model quality, in turn, requires adequate support for *process model refactoring* which improves the quality of a process model without altering the observable behavior. Finally, to provide feedback regarding the execution of real-world processes and to foster organizational learning, IT-support for *monitoring, analyzing and mining* flexible processes becomes crucial.

Table 3.1 Mapping Flexibility Needs to Technical Requirements

Flexibility Need	Dimension	Technical Requirement
Variability		Configuration
Looseness		Loosely-specified Processes
Adaptation	Planned	Exception Handling
	Unplanned	Ad-hoc Changes
Evolution	Deferred Evolution,	Versioning
	Immediate Evolution,	Process Instance Migration
	Poor Model Quality,	Refactoring
	Organizational Learning	Monitoring, Analysis and Mining

In addition to the support for variability, looseness, adaptation and evolution, flexible PAISs have to provide several other features to enable process flexibility in practice.

Accountability and traceability. Even though PAISs become less prescriptive with increasing flexibility, both traceability and accountability still need to be guaranteed. Organizations are required to comply with a wide range of regulations like Sarbanes Oxley (SOX) [339] or Basel II [43]. In the context of SOX, for example, it is important to be able to trace back *who* made *which* changes *when* and *why*. For this, executed activities as well as applied process changes have to be logged. If users need to bypass the PAIS, because a change requirement cannot be implemented quickly enough in the PAIS, traceability is no longer guaranteed and a mismatch between the PAIS and the real-world processes it supports exists.

Business compliance. In addition to accountability and traceability, compliance with existing rules and regulations is another fundamental issue. Despite the provided flexibility, it has to be ensured that (dynamic) process changes in PAIS do not

(c) Springer-Verlag, Berlin Heidelberg, 2012 BOOK PREVIEW

lead to such violations or that the reasons of such compliance violations are at least documented to ensure traceability as described above.

Access control. With increasing flexibility, PAISs become more vulnerable to misuse [355, 78]. Therefore, the application of changes at the process type as well as the process instance level must be restricted to authorized users.

Correctness of changes. When adapting or evolving business processes—potentially in the midst of their execution—it has to be ensured that changes are performed in a controlled manner and do not lead to run-time errors; e.g., crashed activity programs due to missing input data, deadlocks due to blocking activities, or data inconsistencies due to lost updates.

User support. With increasing PAIS flexibility the need for user support becomes more and more important [323]. While traditional PAISs provide little maneuvering room for their users, loosely-specified processes require many decisions to be made along the way and therefore require significantly more user experience.

Need for learning from process instance changes. Regarding *instance-specific process adaptations*, same or similar exceptions might occur more than once, making the reuse of existing exception handling procedures desirable [218, 360]. For example, the knowledge that a magnetic resonance tomography (MRT) could not be performed for a patient with cardiac pacemaker is highly relevant when treating other patients with the same or similar problems. Generally, when similar exceptions occur frequently, this often indicates a gap between the modeled processes and the corresponding real-world ones. This misalignment often stems from errors in the design of a process model or is the result of changing requirements. Therefore, flexible PAISs should continuously monitor deviations between a pre-defined process model and the actual process enactment in order to detect discrepancies between modeled and observed process behavior.

In the context of *loosely-specified processes* two process instances are rarely identical. However, similarities between process instances often exist. As a consequence, reuse of previously conducted process instances or the discovery of frequently occurring similar process fragments should be supported.

Concurrency of changes. Any PAIS supporting instance-specific adaptations should be able to cope with *concurrent* changes. In particular, PAISs need to handle situations in which instance-specific adaptations (i.e., ad hoc changes) and evolutionary changes overlap. This is especially important when evolution has to be immediate and not deferred.

3.4 Summary

This chapter discussed the flexibility needs of both pre-specified and loosely-specified processes in detail; i.e., adaptation, evolution, looseness, and variability. Based on these flexibility needs characteristic requirements were derived that any PAIS enabling flexible business process support has to fulfill. PAISs and their process models do not only need to be configurable, be able to deal with exceptions, and

(c) Springer-Verlag, Berlin Heidelberg, 2012 BOOK PREVIEW

allow for changing the execution of single business cases (i.e., process instances) on-the-fly, but must also support the evolution of business processes over time. Responsiveness to change is fundamental for any PAIS and thus continuous process model refactorings are needed to ensure maintainability, especially when process model repositories become increasingly large. Moreover, the monitoring, analysis and mining of processes is fundamental. In addition, this chapter discussed fundamental PAIS features that are also needed to accommodate the described flexibility needs in practice. In particular, traceability and accountability must be ensured at all times and changes need to be performed in a controlled manner to guarantee correctness. Furthermore, security constraints as well as compliance with existing policies and regulations need to be ensured. Flexible PAISs should also assist their users through recommendations and learning from instance deviations.

3.5 Book Structure

Fig. 3.3 depicts the overall organization of the remaining chapters of this book dealing with the four major needs for variability, looseness, adaptation and evolution.

Part II of this book deals with flexibility support for pre-specified processes. This part primarily considers predictable and repetitive processes. Chapter 5 addresses the need for variability in business processes and discusses techniques enabling process configuration support. Chapter 6 explores on the handling of planned adaptations through exception handling techniques, while Chapter 7 deals with unplanned exceptions and their support through ad-hoc changes of individual process instances. Chapter 8 discusses monitoring, analysis and mining support for flexible processes fostering the incremental evolution of business processes. Chapter 9 addresses the requirement for evolution and elaborates on versioning, instance migration and refactoring support. Part II ends with Chapter 10, which discusses business compliance issues in the context of process changes.

Part III of this book focuses on less predictable processes with a comparably low degree of repetition and deals with the need for looseness. Chapter 11 first provides an overview of different approaches and techniques realizing loosely-specified process models. With constraint-based processes, Chapter 12 then introduces one specific approach for realizing loosely-specified processes in more detail.

Part IV deals with the integration of data and processes and discusses the potential for increasing flexibility through such an integrated approach. Chapter 13 introduces object-centric, artifact-based, and data-driven approaches, while Chapter 14 deals with a specific framework enabling flexible object-aware and data-driven processes.

Finally, Part V focuses on tool support. Chapter 15 introduces the Aristaflow BPM Suite process management technology as a representative for a system supporting pre-specified processes including advanced support for adaptation and evolution. Chapter 16 describes Alaska, which provides support for different ap-

(c) Springer-Verlag, Berlin Heidelberg, 2012 BOOK PREVIEW

proaches enabling loosely-specified processes. Additional tools are discussed in Chapter 17.

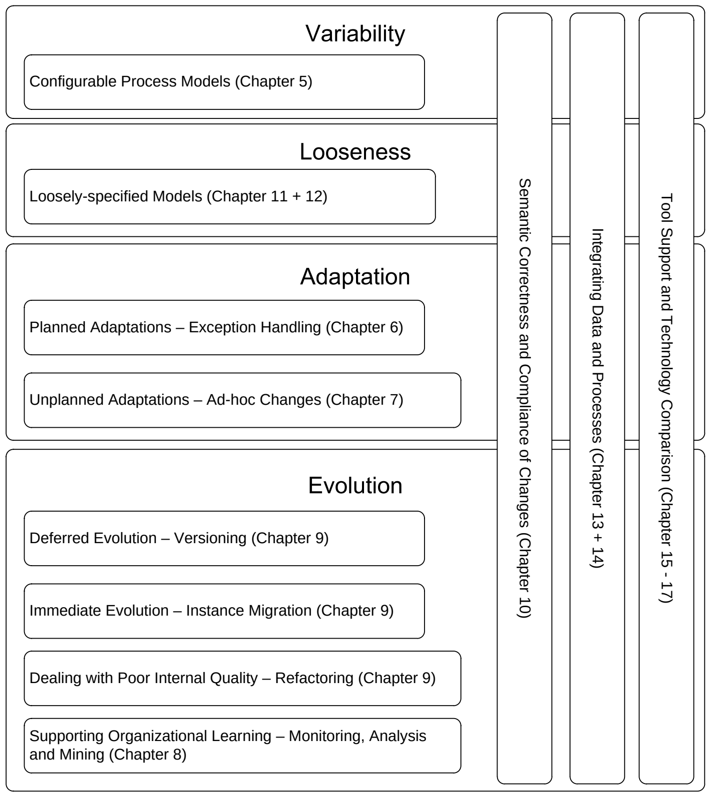

Fig. 3.3 Organization of the Remaining Chapters

Exercises

3.1. Flexibility Needs

In the following the check-in and boarding procedures from the perspective of two hypothetical travelers we will call Tom and Tina Traveler are depicted.

Tom Traveler wants to spend the weekend in Barcelona to explore the city his friends are so enthusiastic about. Since the flight is departing in 90 minutes from the nearby airport in Innsbruck, Tom calls a taxi, which arrives a few minutes later and

(c) Springer-Verlag, Berlin Heidelberg, 2012 BOOK PREVIEW

takes him to the airport which is just a few kilometers from his home. Tom arrives at the airport about an hour before departure. He then immediately goes to the check-in counter where he drops off his bag and gets the boarding pass. Since there is still enough time before boarding Tom decides to drink a quick coffee. Afterwards he gets through security, which is usually quite fast in Innsbruck and only requires a few minutes to complete. For this, Tom has to get his laptop out of his carry-on bag and puts it in the provided bin. He then places his bag as well as his jacket on the conveyor belt to be X-rayed. Having placed the laptop, his bag and the jacket on the conveyor belt, he waits for the signal to proceed through the metal detector. Once he has passed the metal detector, Tom is asked by the screener to take out his camera from the carry-on bag so that she can look through the lens. After this check he is allowed to repack. Tom then buys a newspaper and walks to the gate to wait for the boarding call. Five minutes later boarding starts and Tom enters the airplane.

Like Tom Traveler, Tina Traveler wants to spend the weekend in Barcelona. Tina takes the bus to get to the airport in Innsbruck and arrives about 20 minutes later at the airport. Having arrived at the airport she immediately goes to the check-in counter where she drops off her bag. Unlike Tom, Tina has already printed out her boarding pass at home. After baggage drop-off Tina immediately wants to get through security. Tina places her jacket as well as her carry-on-bag in the provided bin provided on the conveyor belt to be X-rayed. She then waits for the signal to proceed through the metal detector. After the check she gets her carry-on bag as well as her jacket. Tina then buys a newspaper and walks to the gate to wait for the boarding call. A few minutes later boarding starts and Tina enters the airplane.

(a) How would you classify this process in terms of predictability and repeatability?

(b) What kind of flexibility needs can you identify in this context?

3.2. Flexibility Needs

Give examples (others than the ones described in this book) for business processes requiring variability, looseness, adaptation, and evolution.

(a) Give examples where process variability is required. What are the driving forces behind variability in these examples?

(b) Think about processes that are characterized by non-repeatability, unpredictability and emergence and therefore require looseness.

(c) Give examples for both planned and unforeseen process adaptations.

(d) Think about situations where deferred evolution is sufficient. Give examples where immediate evolution is required. Use the taxonomy depicted in Fig. 3.1 to characterize the scenarios.

(c) Springer-Verlag, Berlin Heidelberg, 2012 BOOK PREVIEW

References

1. van der Aalst, W.M.P.: Verification of workflow nets. In: Application and Theory of Petri Nets 1997, *LNCS*, vol. 1248, pp. 407–426. Springer (1997)
2. van der Aalst, W.M.P.: The application of Petri nets to workflow management. The Journal of Circuits, Systems and Computers **8**(1), 21–66 (1998)
3. van der Aalst, W.M.P.: Formalization and verification of event-driven process chains. Information & Software Technology **41**(10), 639–650 (1999)
4. van der Aalst, W.M.P.: Workflow verification: Finding control-flow errors using Petri-net-based techniques. In: Business Process Management, *LNCS*, vol. 1806, pp. 161–183 (2000)
5. van der Aalst, W.M.P.: Exterminating the dynamic change bug: A concrete approach to support worfklow change. Information Systems Frontiers **3**(3), 297–317 (2001)
6. van der Aalst, W.M.P.: Process Mining - Discovery, Conformance and Enhancement of Business Processes. Springer (2011)
7. van der Aalst, W.M.P., Barthelmess, P., Ellis, C.A., Wainer, J.: Workflow modeling using Proclets. In: Proc. 7th Int'l Conf. on Cooperative Information Systems (CoopIS'00), *LNCS*, vol. 1901, pp. 198–209 (2000)
8. van der Aalst, W.M.P., Basten, T.: Identifying commonalities and differences in object life cycles using behavorial inheritance. In: Proc. Int'l Conf. on Application and Theory of Petri Nets (ICATPN'01), LNCS 2075, pp. 32 – 52 (2001)
9. van der Aalst, W.M.P., Basten, T.: Inheritance of workflows: An approach to tackling problems related to change. Theoretical Computer Science **270**(1-2), 125–203 (2002)
10. van der Aalst, W.M.P., de Beer, H.T., van Dongen, B.F.: Process mining and verification of properties: An approach based on temporal logic. In: Proc. 13th Int. Conf. Coop. Inf. Systems (CoopIS'05), *LNCS*, vol. 3760, pp. 130–147. Springer (2005)
11. van der Aalst, W.M.P., van Dongen, B.F., Herbst, J., Maruster, L., Schimm, G., Weijters, A.J.M.M.: Workflow mining: A survey of issues and approaches. Data and Knowledge Engineering **27**(2), 237–267 (2003)
12. van der Aalst, W.M.P., Dumas, M., Gottschalk, F., ter Hofstede, A.H.M., La Rosa, M., Mendling, J.: Preserving correctness during business process model configuration. Formal Asp. Comput. **22**(3-4), 459–482 (2010)
13. van der Aalst, W.M.P., van Hee, K.: Workflow Management. MIT Press (2002)
14. van der Aalst, W.M.P., Jablonski, S.: Dealing with workflow change: Identification of issues an solutions. Int'l Journal of Comp. Systems, Science and Engineering **15**(5), 267–276 (2000)
15. van der Aalst, W.M.P., Lassen, K.B.: Translating unstructured workflow processes to readable BPEL: Theory and implementation. Inf. Softw. Technol. **50**, 131–159 (2008)
16. van der Aalst, W.M.P., Lohmann, N., La Rosa, M., Xu, J.: Correctness ensuring process configuration: An approach based on partner synthesis. In: BPM, *LNCS*, vol. 6336, pp. 95–111. Springer (2010)
17. van der Aalst, W.M.P., Mans, R.S., Russell, N.C.: Workflow support using Proclets: Divide, interact and conquer. Bulletin of the IEEE Computer Society Technical Committee on Data Engineering **32**(3), 16–22 (2009)
18. van der Aalst, W.M.P., Pesic, M.: DecSerFlow: Towards a truly declarative service flow language. Tech. rep., BPMcenter.org (2006)
19. van der Aalst, W.M.P., Pesic, M., Schonenberg, H.: Declarative workflows: Balancing between flexibility and support. Computer Science - R&D **23**(2), 99–113 (2009)
20. van der Aalst, W.M.P., Reijers, H.A., Song, M.K.: Discovering social networks from event logs. Computer Supported Cooperative Work **14**(6), 549–593 (2005)
21. van der Aalst, W.M.P., Rosemann, M., Dumas, M.: Deadline-based escalation in process-aware information systems. Decision Support Systems **43**, 492–511 (2007)
22. van der Aalst, W.M.P., ter Hofstede, A.H.M.: YAWL: yet another workflow language. Information Systems **30**(4), 245–275 (2005)

(c) Springer-Verlag, Berlin Heidelberg, 2012 BOOK PREVIEW

23. van der Aalst, W.M.P., ter Hofstede, A.H.M., Kiepuszewski, B., Barros, A.P.: Workflow patterns. Distributed and Parallel Databases **14**(1), 5–51 (2003)
24. van der Aalst, W.M.P., Weske, M., Grünbauer, D.: Case handling: A new paradigm for business process support. Data & Knowledge Engineering (2004)
25. van der Aalst, W.M.P., Weske, M., Grünbauer, D.: Case handling: A new paradigm for business process support. Data and Knowledge Engineering **53**(2), 129–162 (2005)
26. van der Aalst, W.M.P., et al.: Process mining manifesto. In: Business Process Management Workshops (1), pp. 169–194 (2011)
27. Aamodt, A., Plaza, E.: Case-based reasoning: Foundational issues, methodological variations and system approaches. AI Communications **7**(2), 39–59 (1994)
28. Abecker, A., Bernardi, A., van Elst, L., Lauer, A., Maus, H., Schwarz, S., Sintek, M.: Frodo: A framework for distributed organizational memories. milestone 1: Requirements analysis and system architecture. DFKI document, DFKI (2001)
29. Adams, M., ter Hofstede, A.H.M., van der Aalst, W.M.P., Edmond, D.: Dynamic, extensible and context-aware exception handling for workflows. In: Proc. CoopIS'07 (2007)
30. Adams, M., ter Hofstede, A.H.M., Edmond, D., van der Aalst, W.M.P.: A service-oriented implementation of dynamic flexibility in workflows. In: Proc. Coopis'06 (2006)
31. Adams, M., ter Hofstede, A.H.M., Edmond, D., van der Aalst, W.M.P.: Dynamic and extensible exception handling for workflows: A service-oriented implementation. Tech. Rep. BPM Center Report BPM-07-03, BPMcenter.org (2007)
32. Aggarwal, R., Verma, K., Miller, J., Milnor, W.: Constraint driven web service composition in METEOR-S. In: Proc. Int'l Conf on Services Computing (SCC 2004), pp. 23 – 30 (2004)
33. Aha, D.W., Muñoz-Avila, H.: Introduction: Interactive case-based reasoning. Applied Intelligence **14**(1), 7–8 (2001)
34. Alberti, M., et al.: Expressing and verifying business contracts with abductive logic programming. In: Proc. 2nd Int. Conf. Normative Multi-agent Systems (NorMAS'07), Dagstuhl Seminar Proceedings (2007)
35. Alonso, G., Casati, F., Kuno, H., Machiraju, V.: Web Services – Concepts, Architectures and Applications. Springer (2004)
36. Andany, J., Leonard, M., Palisser, C.: Management of schema evolution in databases. In: Proc. Int'l Conf. on Very Large Databases (VLDB'91), pp. 161–170. Barcelona (1991)
37. Awad, A., Decker, G., Weske, M.: Efficient compliance checking using BPMN-Q and temporal logic. In: Proc. 6th Int. Conf. Business Process Management (BPM'08), pp. 326–341. Springer (2008)
38. Awad, A., Weidlich, M., Weske, M.: Specification, verification and explanation of violation for data-aware compliance rules. In: Proc. of 7th Int. Conf. Service Oriented Computing (ICSOC'09), pp. 500–515. Springer (2009)
39. Ayora, C., Torres, V., Pelechano, V.: Variability management in business process models. Tech. Rep. 17, PROS - UPV (2012)
40. Bandinelli, S., Fugetta, A., Ghezzi, C.: Software process model evolution in the SPADE environment. IEEE Transactions on Software Engineering **19**(12), 1128–1144 (1993)
41. Barba, I., Del Valle, C.: A constraint-based approach for planning and scheduling repeated activities. In: Proc. COPLAS, pp. 55–62 (2011)
42. Barba, I., Weber, B., Del Valle, C.: Supporting the optimized execution of business processes through recommendations. In: Business Process Management Workshops (1), pp. 135–140 (2011)
43. Basel Committee on Banking Supervision: Int'l convergence of capital measurement and capital standards: A revised framework - comprehensive version. Tech. rep., Bank for Int'l Settlements (2006)
44. Bassil, S., Benyoucef, M., Keller, R., Kropf, P.: Addressing dynamism in e-negotiations by workflow management systems. In: Proc. Workshop on Negotiations in e-Markets – Beyond Price Discovery (DEXA'02) (2002)
45. Bassil, S., Keller, R., Kropf, P.: A workflow–oriented system architecture for the management of container transportation. In: J. Desel, B. Pernici, M. Weske (eds.) Proc. BPM'04, LNCS 3080, pp. 116–131. Potsdam, Germany (2004)

(c) Springer-Verlag, Berlin Heidelberg, 2012 BOOK PREVIEW

46. Batory, D.S.: Feature models, grammars, and propositional formulas. In: 9th Int'l Conf. on Software Product Lines, LNCS, pp. 7–20. Springer (2005)
47. Bauer, T., Reichert, M., Dadam, P.: Intra-subnet load balancing in distributed workflow management systems. Int'l Journal Cooperative Information Systems **12**(3), 295–324 (2003)
48. Beck, K.: Extreme Programming Explained. Addison Wesley (2000)
49. Becker, J., Delfmann, P., Knackstedt, R.: Adaptive reference modeling. integrating configurative and generic adaptation techniques for information models. In: P. Becker J.; Delfmann (ed.) Reference Modeling. Efficient Information Systems Design Through Reuse of Information Models, pp. 23–49. Physica-Verlag HD (2007)
50. Becker, J., Kugeler, M., Rosemann, M.: Process management: a guide for the design of business processes. Springer (2003)
51. Beckstein, C., Klausner, J.: A planning framework for workflow management. In: Proc. Workshop Intelligent Workflow and Process Management. Stockholm (1999)
52. Bensalem, S., et al.: An overview of SAL. In: Proc. of the 5th NASA Langley Formal Methods Workshop, pp. 187–196. NASA Langley Research Center (2000)
53. Bhattacharya, K., Hull, R., Su, J.: A Data-Centric Design Methodology for Business Processes, pp. 503–531. IGI Global (2009)
54. Bobrik, R., Bauer, T., Reichert, M.: Proviado - personalized and configurable visualizations of business processes. In: Proc. 7th Int'l Conf. on Electronic Commerce and Web Technologies (EC-WEB'06), no. 4082 in LNCS, pp. 61–71. Springer (2006)
55. Bobrik, R., Reichert, M., Bauer, T.: View-based process visualization. In: Proc. BPM'07, *LNCS*, vol. 4714, pp. 88–95. Springer (2007)
56. Boehm, B.W.: Software Engineering Economics. Prentice Hall (1981)
57. Bose, R.P.J.C., van der Aalst, W.M.P., Zliobaite, I., Pechenizkiy, M.: Handling concept drift in process mining. In: CAiSE, pp. 391–405 (2011)
58. Brant, J., Roberts, D.: Refactoring Browser: st-www.cs.uiuc.edu/users/brant/refactoringbrowser/
59. Canfora, G., Di Penta, M., Esposito, R., Villani, M.L.: A framework for QoS-aware binding and re-binding of composite web services. J. Syst. Softw. **81**(10), 1754–1769 (2008)
60. Casati, F.: Models, semantics, and formal methods for the design of workflows and their exceptions. Ph.D. thesis, Milano (1998)
61. Casati, F., Ceri, S., Paraboschi, S., Pozzi, G.: Specification and implementation of exceptions in workflow management systems. ACM TODS **24**(3), 405–451 (1999)
62. Casati, F., Ceri, S., Pernici, B., Pozzi, G.: Workflow evolution. Data and Knowledge Engineering **24**(3), 211–238 (1998)
63. Casati, F., Shan, M.C.: Dynamic and adaptive composition of e-services. Information Systems **26**(3), 143 – 163 (2001)
64. Castellanos, M., Alves de Medeiros, K., Mendling, J., Weber, B., Weitjers, A.J.M.M.: Handbook of Research on Business Process Modeling, chap. Business Process Intelligence, pp. 456–480. Idea Group Inc (2009)
65. Chiao, C.M., Künzle, V., Reichert, M.: Towards object-aware process support in healthcare information systems. In: Proc. 4th Int'l Conf. on eHealth, Telemedicine, and Social Medicine (eTELEMED 2012) (2012)
66. Chiu, D., Li, Q., Karlapalem, K.: Web interface-driven cooperative exception handling in ADOME. Informations Systems **26**(2), 93–120 (2001)
67. Cohn, D., Hull, R.: Business artifacts: A data-centric approach to modeling business operations and processes. IEEE Data Eng. Bull. **32**(3), 3–9 (2009)
68. Cohn, M.: Agile Estimating and Planning. Prentice Hall Professional (2006)
69. Combi, C., Gambini, M.: Flaws in the flow: The weakness of unstructured business process modeling languages dealing with data. In: OTM Confs (1), pp. 42–59 (2009)
70. Cortadella, J., Kishinevsky, M., Lavagno, L., Yakovlev, A.: Deriving petri nets from finite transition systems. IEEE Transactions on Computers **47**(8), 859–882 (1998)
71. Dadam, P., Reichert, M.: The ADEPT project: a decade of research and development for robust and flexible process support. Computer Science - R&D **23**(2), 81–97 (2009)

(c) Springer-Verlag, Berlin Heidelberg, 2012 BOOK PREVIEW

72. Dadam, P., Reichert, M., Kuhn, K.: Clinical workflows – the killer application for process-oriented information systems? In: Proc. Int'l Conf. on Business Information Systems (BIS'00), pp. 36–59. Poznan, Poland (2000)
73. Davies Jr., C.T.: Data processing spheres of control. IBM Systems Journal **17**(2), 179 –198 (1978)
74. Deiters, W., Gruhn, V.: The FUNSOFT net appoach to software process management. Int'l Journal of Software Engineering and Knowledge Engineering **4**(2), 229–256 (1994)
75. Dijkman, R., Dumas, M., van Dongen, B., Kaarik, R., Mendling, J.: Similarity of business process models: Metrics and evaluation. Information Systems **36**(2), 498–516 (2011)
76. Dijkman, R., Gfeller, B., Küster, J., Völzer, H.: Identifying refactoring opportunities in process model repositories. Information and Software Technology **53**(9), 937 – 948 (2011). Studying work practices in Global Software Engineering
77. Dijkstra, E.W.: Chapter I: Notes on structured programming. In: O.J. Dahl, E.W. Dijkstra, C.A.R. Hoare (eds.) Structured programming, pp. 1–82. Academic Press (1972)
78. Domingos, D., Rito-Silva, A., Veiga, P.: Authorization and access control in adaptive workflows. In: ESORICS 2003, pp. 23–38 (2003)
79. van Dongen, B.F., van der Aalst, W.M.P.: Multi-phase process mining: Building instance graphs. In: ER'04, LNCS 3288, pp. 362–376. Berlin (2004)
80. van Dongen, B.F., van der Aalst, W.M.P., Verbeek, H.M.W.: Verification of EPCs: Using reduction rules and Petri nets. In: CAiSE, pp. 372–386 (2005)
81. Dourish, P., Holmes, J., MacLean, A., Marqvardsen, P., Zbyslaw, A.: Freeflow: mediating between representation and action in workflow systems. In: Proc. ACM Conf. on Computer Supported Cooperative Work, CSCW '96, pp. 190–198 (1996)
82. Dumas, M., García-Bañuelos, L., Dijkman, R.M.: Similarity search of business process models. IEEE Data Eng. Bull. **32**(3), 23–28 (2009)
83. Dumas, M., ter Hofstede, A.H.M., van der Aalst, W.M.P. (eds.): Process-Aware Information Systems. Wiley Publishing (2005)
84. Dwyer, M.B., Avrunin, G.S., Corbett, J.C.: Property specification patterns for finite-state verification. In: Proc. 2nd Workshop Formal Methods in Software Practice (FMSP'98). ACM (1998)
85. Eder, J., Liebhart, W.: Workflow transactions. In: Handbook of the Workflow Management Coalition WfMC, pp. 195–202. WfMC (1997)
86. Eder, J., Tahamtan, A.: Temporal conformance of federated choreographies. In: Proc. 19th Int. Conf. Database and Expert Sys. App. (DEXA'08), pp. 668–675. Springer (2008)
87. Ellis, C.A., Keddara, K., Rozenberg, G.: Dynamic change within workflow systems. In: Proc. ACM Conf. on Organizational Computing Systems (COOCS'95), pp. 10–21. Milpitas, CA (1995)
88. Ellis, C.A., Maltzahn, C.: The Chautauqua workflow system. In: Proc. Int'l Conf. on System Science. Maui, Hawaii (1997)
89. Elmagarmid, A.K. (ed.): Database Transaction Models for Advanced Applications. Morgan Kaufmann (1992)
90. Fahland, D., Woith, H.: Towards process models for disaster response. In: Proc. BPM '08, pp. 254–265 (2008)
91. Fent, A., Reiter, H., Freitag, B.: Design for change: Evolving workflow specifications in ULTRAflow. In: Proc. Int'l Conf. on Advanced Information Systems Engineering (CAISE'02), pp. 516–534 (2002)
92. Fowler, M., Beck, K., Brant, J., Opdyke, W., Roberts, D.: Refactoring: improving the design of existing code. Addison-Wesley (1999)
93. Frauenhofer ISST: SPOT Project. http://www.spot.fraunhofer.de/ (accessed 13.07.2010) (2010)
94. Gabbay, D., Pnueli, A., Shelah, S., Stavi, J.: On the temporal analysis of fairness. In: Proc. of the 7th ACM SIGPLAN-SIGACT Symposium on Principles of programming languages, pp. 163–173 (1980)
95. Garcia-Molina, H., Gawlick, D., Klein, J., Kleissner, K., Salem, K.: Modeling long-running activities as nested Sagas. Data Engineering **14**, 14–18 (1991)

(c) Springer-Verlag, Berlin Heidelberg, 2012 BOOK PREVIEW

96. Garcia-Molina, H., Salem, K.: Sagas. In: SIGMOD Conference, pp. 249–259 (1987)
97. Gebauer, J., Schober, F.: Information system flexibility and the cost efficiency of business processes. J. of the Assoc. for Information Systems **7**(3), 122–147 (2006)
98. Ghattas, J., Peleg, M., Soffer, P., Denekamp, Y.: Learning the context of a clinical process. In: Business Process Management Workshops, *LNBIP*, vol. 43, pp. 545–556. Springer (2009)
99. Ghattas, J., Soffer, P., Peleg, M.: A formal model for process context learning. In: Business Process Management Workshops, *LNBIP*, vol. 43, pp. 140–157. Springer (2009)
100. Ghose, A., Koliadis, G.: Auditing business process compliance. In: Proc. 5th Int. Conf. Service-Oriented Computing (ICSOC'07), pp. 169–180. Springer (2007)
101. Giblin, C., Müller, S., Pfitzmann, B.: From regulatory policies to event monitoring rules: Towards model-driven compliance automation. Tech. Rep. RZ-3662, IBM Research GmbH (2006)
102. van Glabbeek, R., Weijland, W.P.: Branching time and abstraction in bisimulation semantics. Journal of the ACM **43**(3), 555–600 (1996)
103. Goedertier, S., Vanthienen, J.: Designing compliant business processes with obligations and permissions. In: Proc. BPM'06 Workshops, pp. 5–14. Springer (2006)
104. Gottschalk, F.: Configurable process models. Ph.D. thesis, Eindhoven University of Technology, The Netherlands (2009)
105. Gottschalk, F., van der Aalst, W.M.P., Jansen-Vullers, M.H.: Merging event-driven process chains. In: OTM Confs (1), *LNCS*, vol. 5331, pp. 418–426. Springer (2008)
106. Gottschalk, F., van der Aalst, W.M.P., Jansen-Vullers, M.H., La Rosa, M.: Configurable workflow models. Int. J. Cooperative Inf. Syst. **17**(2), 177–221 (2008)
107. Gottschalk, F., Wagemakers, T.A.C., Jansen-Vullers, M.H., van der Aalst, W.M.P., La Rosa, M.: Configurable process models: Experiences from a municipality case study. In: CAiSE'09, pp. 486–500 (2009)
108. Governatori, G., Milosevic, Z., Sadiq, S.: Compliance checking between business processes and business contracts. In: Proc. 10th Int. Enterprise Distributed Object Computing Conf. (EDOC'06), pp. 221–232. IEEE Computer Society (2006)
109. Grambow, G., Oberhauser, R., Reichert, M.: Employing semantically driven adaptation for amalgamating software quality assurance with process management. In: Second Int'l Conf on Adaptive and Self-adaptive Systems and Applications (ADAPTIVE'10), pp. 58–67. Xpert Publ Services (2010)
110. Grambow, G., Oberhauser, R., Reichert, M.: Semantic workflow adaption in support of workflow diversity. In: 4th Int'l Conf on Advances in Semantic Processing (SEMAPRO'10), pp. 158–165. Xpert Publ Services (2010)
111. Grambow, G., Oberhauser, R., Reichert, M.: Contextual injection of quality measures into software engineering processes. Int'l Journal on Advances in Software **4**(1&2), 76–99 (2011)
112. Grambow, G., Oberhauser, R., Reichert, M.: Semantically-driven workflow generation using declarative modeling for processes in software engineering. In: EDOCW, pp. 164–173 (2011)
113. Grambow, G., Oberhauser, R., Reichert, M.: Towards a workflow language for software engineering. In: Proc. 10th IASTED Int. Conf. on Software Engineering (SE'11) (2011)
114. Grambow, G., Oberhauser, R., Reichert, M.: Towards automatic process-aware coordination in collaborative software engineering. In: ICSOFT (1), pp. 5–14 (2011)
115. Gray, J., Reuter, A.: Transaction Processing: Concepts and Techniques. Morgan Kaufmann (1993)
116. Green, T.R.: Cognitive dimensions of notations. In: Proc. BCSHCI '89, pp. 443–460 (1989)
117. Green, T.R., Petre, M.: Usability analysis of visual programming environments: A 'cognitive dimensions' framework. JVLC **7**(2), 131–174 (1996)
118. Grosskopf, A., Decker, G., Weske, M.: The Process: Business Process Modeling Using BPMN. Meghan Kiffer Pr (2009)
119. Gruhn, V., Laue, R.: Complexity metrics for business process models. In: Proc. BIS'06, pp. 1–12 (2006)
120. Günther, C.W., Reichert, M., van der Aalst, W.M.P.: Supporting flexible processes with adaptive workflow and case handling. In: Proc. WETICE'08, 3rd IEEE Workshop on Agile Cooperative Process-aware Information Systems (ProGility'08), pp. 229–234. IEEE Computer Society Press (2008)

(c) Springer-Verlag, Berlin Heidelberg, 2012 BOOK PREVIEW

121. Günther, C.W., Rinderle, S., Reichert, M., van der Aalst, W.M.P.: Change mining in adaptive process management systems. In: Proc. CoopIS'06, *LNCS*, vol. 4275, pp. 309–326. Springer (2006)
122. Günther, C.W., Rinderle-Ma, S., Reichert, M., van der Aalst, W.M., Recker, J.: Using process mining to learn from process changes in evolutionary systems. Int'l Journal of Business Process Integration and Management, Special Issue on Business Process Flexibility **3**(1), 61–78 (2008)
123. Hagen, C., Alonso, G.: Exception handling in workflow management systems. IEEE Transactions on Software Engineering **26**(10), 943–958 (2000)
124. Haisjackl, C., Weber, B.: User assistance during process execution - an experimental evaluation of recommendation strategies. In: Business Process Management Workshops, pp. 134–145 (2010)
125. Hallerbach, A.: Management von Prozessvarianten. Ph.D. thesis, Univ. of Ulm (2010)
126. Hallerbach, A., Bauer, T., Reichert, M.: Context-based configuration of process variants. In: Proc. TCoB '08, pp. 31–40 (2008)
127. Hallerbach, A., Bauer, T., Reichert, M.: Managing process variants in the process life cycle. In: ICEIS (3-2), pp. 154–161 (2008)
128. Hallerbach, A., Bauer, T., Reichert, M.: Guaranteeing soundness of configurable process variants in Provop. In: Proc. 11th IEEE Conf. on Commerce and Enterprise Computing (CEC'09), pp. 98–105. IEEE Computer Society Press (2009)
129. Hallerbach, A., Bauer, T., Reichert, M.: Capturing variability in business process models: The Provop approach. Journal of Software Maintenance and Evolution: Research and Practice **22**(6/7), 519–546 (2010)
130. Hallerbach, A., Bauer, T., Reichert, M.: Configuration and Management of Process Variants, pp. 237–255. Springer (2010)
131. Hammer, M., Champy, J.: Reengineering the Corporation. Harper Collins (1993)
132. Hammer, M., Stanton, S.: The Reengineering Revolution – The Handbook. Harper Collins Publ. (1995)
133. Hensinger, C., Reichert, M., Bauer, T., Strzeletz, T., Dadam, P.: ADEPT$_{workflow}$ - advanced workflow technology for the efficient support of adaptive, enterprise-wide processes. In: Proc. Software Demonstration Track (EDBT'00). Konstanz (2000)
134. Herbst, J., Karagiannis, D.: Intergrating machine learning and workflow management to support acquisition and adaption of workflow models. In: Proc. Workshop on Database and Expert Systems Applications (DEXA'98), pp. 745–752. Vienna (1998)
135. Hochstein, A., Zarnekow, R., Brenner, W.: ITIL as common practice reference model for it service management: Formal assessment and implications for practice. In: IEEE Int'l Conf on e-Technology, e-Commerce, and e-Services (EEE'05), pp. 704–710 (2005)
136. ter Hofstede, A.H.M., van der Aalst, W.M.P., Adams, M., Russell, N.: Modern Business Process Automation: YAWL and Its Support Environment. Springer (2009)
137. Huth, M., Ryan, M.: Logic in Computer Science: Modelling and reasoning about systems. Cambridge University Press (2004)
138. Imai, M.: Kaizen: The Key to Japan's Competitive Success. McGraw-Hill/Irwin (1986)
139. Jablonski, S., Bussler, C.: Workflow Management: Concepts, Architecture and Implementation. Thompson Publishers (1996)
140. Joeris, G., Herzog, O.: Managing evolving workflow specifications. In: Proc. Int'l Conf. on Cooperative Information Systems (CoopIS'98), pp. 310–321. New York City (1998)
141. Jørgensen, H.D.: Interactive process models. Ph.D. thesis, Trondheim (2004)
142. Karbe, B., Ramsperger, N., Weiss, P.: Support of cooperative work by electronic circulation folders. SIGOIS Bulletin **11**, 109–117 (1990)
143. Kiepuszewski, B.: Expressiveness and suitability of languages for control flow modelling in workflows. Ph.D. thesis, Queensland University of Technology, Brisbane (2002). (available via *http://www.tm.tue.nl/it/research/patterns)*
144. Kiepuszewski, B., ter Hofstede, A., Bussler, C.: On structured workflow modelling. In: Proc. Int'l Conf. on Advanced Information Systems Engineering (CAiSE'00), pp. 431–445 (2000)

(c) Springer-Verlag, Berlin Heidelberg, 2012 BOOK PREVIEW

145. Klingemann, J.: Controlled flexibility in workflow management. In: Proc. CAiSE'00, *LNCS*, vol. 1789, pp. 126–141 (2000)
146. Knuplesch, D., Ly, L.T., Rinderle-Ma, S., Pfeifer, H., Dadam, P.: On enabling data-aware compliance checking of business process models. In: Proc. 29th Int. Conf. Conceptual Modeling (ER'2010). Springer (2010)
147. Kochut, K., Arnold, J., Sheth, A., Miller, J., Kraemer, E., Arpinar, B., Cardoso, J.: IntelliGEN: A distributed workflow system for discovering protein-protein interactions. Distributed and Parallel Databases **13**(1), 43–72 (2003)
148. Kock, N.F.: Product flow, breadth and complexity of business processes: An empirical study of 15 business processes in three organizations. Business Process Re-engineering & Management Journal **2**(2), 8–22 (1996)
149. Koehler, J., Vanhatalo, J.: Process anti-patterns: How to avoid the common traps of business process modeling. Tech. Rep. Report RZ-3678, IBM Zurich Research Lab (2007)
150. Kokash, N., Krause, C., de Vink, E.: Time and data aware analysis of graphical service models. In: Proc. 8th Int. Conf. Software Engineering and Formal Methods (SEFM'10). IEEE Computer Society (2010)
151. Kolodner, J.L.: Case-Based Reasoning. Morgan Kaufmann (1993)
152. Koschmider, A., Song, M., Reijers, H.A.: Advanced social features in a recommendation system for process modeling. In: Proc. Business Information Systems (BIS'09), no. 21 in LNBIP, pp. 109–120. Springer (2009)
153. Kowalkiewicz, M., Lu, R., Baeuerle, S., Kruempelmann, M., Lippe, S.: Weak dependencies in business process models. In: Proc. 11th Int'l Conf. on Business Information Systems (BIS'08), pp. 177–188 (2008)
154. Kradolfer, M., Geppert, A.: Dynamic workflow schema evolution based on workflow type versioning and workflow migration. Tech. Rep. 98.02, University of Zurich, Department of Computer Science (1998)
155. Kradolfer, M., Geppert, A.: Dynamic workflow schema evolution based on workflow type versioning and workflow migration. In: Proc. Int'l Conf. in Cooperative Information Systems (CoopIS'99), pp. 104–114. Edinburgh (1999)
156. Künzle, V., Reichert, M.: Integrating users in object-aware process management systems: Issues and challenges. In: BPM'09 Workshops, *LNBIP*, vol. 43, pp. 29–41. Springer (2009)
157. Künzle, V., Reichert, M.: Towards object-aware process management systems: Issues, challenges, benefits. In: BPMDS/EMMSAD'09, *LNBIP*, vol. 29, pp. 197–210. Springer (2009)
158. Künzle, V., Reichert, M.: A Modeling Paradigm for Integrating Processes and Data at the Micro Level. In: Proc. BPMDS'11, LNBIP, pp. 201 – 215. Springer (2011)
159. Künzle, V., Reichert, M.: PHILharmonicFlows: Towards a framework for object-aware process management. Journal of Software Maintenance and Evolution: Research and Practice **23**(4), 205–244 (2011)
160. Künzle, V., Reichert, M.: Striving for object-aware process support: How existing approaches fit together. In: 1st Int'l Symposium on Data-driven Process Discovery and Analysis (SIMPDA'11) (2011)
161. Künzle, V., Weber, B., Reichert, M.: Object-aware business processes: Fundamental requirements and their support in existing approaches. Int'l Journal of Information System Modeling and Design **2**, 19–46 (2010)
162. Küster, J.M., Gerth, C., Förster, A., Engels, G.: Detecting and resolving process model differences in the absence of a change log. In: BPM'08, *LNCS*, vol. 5240, pp. 244–260. Springer (2008)
163. La Rosa, M.: Managing variability in process-aware information systems. Ph.D. thesis, Queensland University of Technology, Brisbane, Australia (2009)
164. La Rosa, M., van der Aalst, W.M.P., Dumas, M., ter Hofstede, A.H.M.: Questionnaire-based variability modeling for system configuration. Software and System Modeling **8**(2), 251–274 (2009)
165. La Rosa, M., Dumas, M., ter Hofstede, A.H.M.: Handbook of Research on Business Process Modeling, chap. Modelling Business Process Variability for Design-Time Configuration, pp. 204–228. Idea Group Inc (2009)

(c) Springer-Verlag, Berlin Heidelberg, 2012 BOOK PREVIEW

166. La Rosa, M., Dumas, M., ter Hofstede, A.H.M., Mendling, J.: Configurable multi-perspective business process models. Inf. Syst. **36**(2), 313–340 (2011)
167. La Rosa, M., Dumas, M., ter Hofstede, A.H.M., Mendling, J., Gottschalk, F.: Beyond control-flow: Extending business process configuration to roles and objects. In: Proc. 27th Int'l Conf on Conceptual Modeling (ER'08), *LNCS*, vol. 5231, pp. 199–215. Springer (2008)
168. La Rosa, M., Dumas, M., Uba, R., Dijkman, R.M.: Merging business process models. In: OTM Confs (1), *LNCS*, vol. 6426, pp. 96–113. Springer (2010)
169. Lanz, A., Kreher, U., Reichert, M., Dadam, P.: Enabling process support for advanced applications with the AristaFlow BPM Suite. In: Proc. of the Business Process Management 2010 Demonstration Track, no. 615 in CEUR Workshop Proceedings (2010)
170. Lanz, A., Reichert, M., Dadam, P.: Robust and flexible error handling in the AristaFlow BPM Suite. In: Proc. CAiSE'10 Forum, Information Systems Evolution, no. 72 in LNBIP, pp. 174–189. Springer (2010)
171. Lanz, A., Weber, B., Reichert, M.: Workflow time patterns for process-aware information systems. In: Proc. BPMDS and EMMSAD 2010, LNBIP 50, pp. 94–107 (2010)
172. Laue, R., Mendling, J.: Structuredness and its significance for correctness of process models. Information Systems and E-Business Management **8**, 287–307 (2010)
173. Lenz, R., Reichert, M.: IT support for healthcare processes - premises, challenges, perspectives. Data and Knowledge Engineering **61**(1), 39–58 (2007)
174. de Leoni, M.: Adaptive process management in highly dynamic and pervasive scenarios. In: Proc. Fourth European Young Researchers Workshop on Service Oriented Computing, (YR-SOC 2009), *EPTCS*, vol. 2, pp. 83–97 (2009)
175. Leopold, H., Smirnov, S., Mendling, J.: Refactoring of activity labels in business process models. In: 15th Int'l Conf on Applications of Natural Language to Information Systems (NLDB 2010), pp. 268–276 (2010)
176. Leopold, H., Smirnov, S., Mendling, J.: Recognizing activity labeling styles in business process models. Enterprise Modelling and Information Systems Architectures - Int'l Journal (EMISA Journal) - accepted for publication **6**(1), 16–29 (2011)
177. Lerner, B.S., Christov, S., Osterweil, L.J., Bendraou, R., Kannengiesser, U., Wise, A.E.: Exception handling patterns for process modeling. IEEE Trans. Software Eng. **36**(2), 162–183 (2010)
178. Leymann, F.: Supporting business transactions via partial recovery in workflow management systems. In: Proc. Datenbanksysteme in Büro, Technik und Wissenschaft (BTW'95), pp. 51–70. Dresden (1995)
179. Leymann, F., Roller, D.: Production Workflow. Prentice Hall (2000)
180. Li, C.: Mining process model variants: Challenges, techniques, examples. Ph.D. thesis, University of Twente, The Netherlands (2009)
181. Li, C., Reichert, M., Wombacher, A.: Discovering reference process models by mining process variants. In: Proc. 6th Int'l Conference on Web Services (ICWS'08), pp. 45–53. IEEE Computer Society Press (2008)
182. Li, C., Reichert, M., Wombacher, A.: On measuring process model similarity based on high-level change operations. In: Proc. ER'08, *LNCS*, vol. 5231, pp. 248–264. Springer (2008)
183. Li, C., Reichert, M., Wombacher, A.: Discovering reference models by mining process variants using a heuristic approach. In: Proc. 7th Int'l Conf. on Business Process Management (BPM'09), no. 5701 in LNCS, pp. 344–362. Springer (2009)
184. Li, C., Reichert, M., Wombacher, A.: Mining based on learning from process change logs. In: Proc. BPM'08 Workshops, no. 17 in LNBIP, pp. 121–133. Springer (2009)
185. Li, C., Reichert, M., Wombacher, A.: What are the problem makers: Ranking activities according to their relevance for process changes. In: IEEE 7th Int'l Conf on Web Services (ICWS'09), pp. 51–58. IEEE Computer Society Press (2009)
186. Li, C., Reichert, M., Wombacher, A.: The MinAdept clustering approach for discovering reference process models out of process variants. Int'l Journal of Cooperative Information Systems **19**(3 & 4), 159–203 (2010)
187. Li, C., Reichert, M., Wombacher, A.: Mining business process variants: Challenges, scenarios, algorithms. Data & Knowledge Engineering **70**(5), 409–434 (2011)

(c) Springer-Verlag, Berlin Heidelberg, 2012 BOOK PREVIEW

188. Liu, C., Conradi, R.: Automatic replanning of task networks for process model evolution. In: Proc. European Software Engineering Conf, pp. 434–450. Garmisch-Partenkirchen, Germany (1993)
189. Liu, R., Bhattacharya, K., Wu, F.Y.: Modeling business contexture and behavior using business artifacts. Advanced Information Systems Engineering **4495**, 324–339 (2007)
190. Liu, Y., Müller, S., Xu, K.: A static compliance-checking framework for business process models. IBM Systems Journal **46**(2), 335–261 (2007)
191. Lohmann, N., Wolf, K.: Compact representations and efficient algorithms for operating guidelines. Fundam. Inform. **108**(1-2), 43–62 (2011)
192. Lu, R., Sadiq, S.W.: Managing process variants as an information resource. In: Proc. BPM'06, pp. 426–431 (2006)
193. Luengo, D., Seplveda, M.: Applying clustering in process mining to find different versions of a business process that changes over time. In: Business Process Management Workshops (2011)
194. Luger, G.F.: Artificial Intelligence: Structures and Strategies for Complex Problem Solving. Pearson (2005)
195. Luo, Z., Sheth, A., Kochut, K., Miller, J.: Exception handling in workflow systems. Applied Intelligence **13**(2), 125–147 (2000)
196. Ly, L.T., Knuplesch, D., Rinderle-Ma, S., Göser, K., Pfeifer, H., Reichert, M., Dadam, P.: SeaFlows Toolset – compliance verification made easy for process-aware information systems. In: Proc. CAiSE'10 Forum, no. 72 in LNBIP, pp. 76–91. Springer (2010)
197. Ly, L.T., Rinderle, S., Dadam, P.: Integration and verification of semantic constraints in adaptive process management systems. Data & Knowledge Engineering **64**(1), 3–23 (2008)
198. Ly, L.T., Rinderle, S., Dadam, P., Reichert, M.: Mining staff assignment rules from event-based data. In: Proc. BPM'05 Workshops, no. 3812 in LNCS, pp. 177–190. Springer (2005)
199. Ly, L.T., Rinderle-Ma, S., Dadam, P.: Design and verification of instantiable compliance rule graphs in process-aware information systems. In: Proc. 22nd Int. Conf. Advanced Systems Engineering (CAiSE'10), pp. 9–23. Springer (2010)
200. Ly, L.T., Rinderle-Ma, S., Göser, K., Dadam, P.: On enabling integrated process compliance with semantic constraints in process management systems - requirements, challenges, solutions. Inf. Sys. Frontiers (Special Issue Governance, Risk and Compliance) (2009)
201. Ly, L.T., Rinderle-Ma, S., Knuplesch, D., Dadam, P.: Monitoring business process compliance using compliance rule graphs. In: Proc. 19th Int. Conf. Coop. Inf. Systems (CoopIS'11), pp. 82–99. Springer (2011)
202. Maggi, F., Montali, M., Westergaard, M., van der Aalst, W.M.P.: Monitoring business constraints with linear temporal logic: An approach based on colored automata. In: Proc. BPM 2011. Springer (2011)
203. Malone, T., Crowston, K., Herman, G.: Organizing business knowledge: the MIT process handbook. MIT Press (2003)
204. Mann, J.E.: Workflow and EAI. EAI Journal pp. 49–53 (1999)
205. Mans, R.S., Russell, N.C., van der Aalst, W.M.P., Moleman, A.J., Bakker., P.J.M.: Schedule-aware workflow management systems. In: Proc. PNSE'09, pp. 81–96 (2009)
206. McCarthy, D., Sarin, S.: Workflow and transactions in inconcert. IEEE Bulletin on Data Engineering **16**(2), 53–56 (1993)
207. Mendling, J., Reijers, H.A.: How to define activity labels for business process models? In: Proc. AIS SIGSAND'08, pp. 117–127 (2008)
208. Mendling, J., Reijers, H.A., van der Aalst, W.M.P.: Seven process modeling guidelines (7PMG). Information and Software Technology **52**(2), 127–136 (2010)
209. Mendling, J., Reijers, H.A., Recker, J.: Activity labeling in process modeling: Empirical insights and recommendations. Information Systems **35**(4), 467–482 (2010)
210. Mendling, J., Verbeek, H.M.W., van Dongen, B.F., van der Aalst, W.M.P., Neumann, G.: Detection and prediction of errors in EPCs of the SAP reference model. Data & Knowledge Engineering **64**(1), 312–329 (2008)
211. Mens, T., Gorp, P.V.: A taxonomy of model transformation. Electr. Notes Theor. Comput. Sci. **152**, 125–142 (2006)

(c) Springer-Verlag, Berlin Heidelberg, 2012 BOOK PREVIEW

212. Mens, T., Tourwe, T.: A survey of software refactoring. IEEE Transactions on Software Engineering **30**(2), 126–139 (2004). DOI http://doi.ieeecomputersociety.org/10.1109/TSE.2004.1265817
213. Meyer, H., Weske, M.: Automated service composition using heuristic search. In: Business Process Management, pp. 81–96 (2006)
214. Miller, G.: The magical number seven, plus or minus two: Some limits on our capacity for processing information. The Psychological Review **63**, 81–97 (1956)
215. Minor, M., Bergmann, R., Görg, S., Walter, K.: Towards case-based adaptation of workflows. In: ICCBR'11, pp. 421–435 (2010)
216. Minor, M., Bergmann, R., Görg, S., Walter, K.: Reasoning on business processes to support change reuse. In: CEC'11, pp. 18–25 (2011)
217. Minor, M., Schmalen, D., Koldehoff, A., Bergmann, R.: Structural adaptation of workflows supported by a suspension mechanism and by case-based reasoning. In: Proc. WETICE'07, pp. 370 – 375 (2007)
218. Minor, M., Tartakovski, A., Bergmann, R.: Representation and structure-based similarity assessment for agile workflows. In: Proc. ICCBR'07, pp. 224–238 (2007)
219. Minor, M., Tartakovski, A., Schmalen, D., Bergmann, R.: Agile workflow technology and case-based change reuse for long-term processes. Int'l J. of Intelligent Information Technologies **4**(1), 80–98 (2008)
220. Montali, M.: Specification and Verification of Declarative Open Interaction Models. Springer Berlin Heidelberg (2010)
221. Montali, M., Pesic, M., van der Aalst, W.M.P., Chesani, F., Mello, P., Storari, S.: Declarative specification and verification of service choreographiess. TWEB **4**(1) (2010)
222. Moss, E.: Nested Transactions. MIT Press (1985)
223. Mourao, H., Antunes, P.: Supporting effective unexpected exceptions handling in workflow management systems. In: Proc. ACM symposium on Applied computing (SAC'07), pp. 1242–1249. ACM Press, New York, NY, USA (2007)
224. Müller, D., Herbst, J., Hammori, M., Reichert, M.: IT support for release management processes in the automotive industry. In: Proc. BPM'06, no. 4102 in LNCS, pp. 368–377. Springer, Vienna (2006)
225. Müller, D., Reichert, M., Herbst, J.: Flexibility of data-driven process structures. In: BPM'06 Int'l Workshops, Workshop on Dynamic Process Management (DPM'06), no. 4103 in LNCS, pp. 181–192. Springer (2006)
226. Müller, D., Reichert, M., Herbst, J.: Data-driven modeling and coordination of large process structures. In: OTM Confs (1), *LNCS*, vol. 4803, pp. 131–149. Springer (2007)
227. Müller, D., Reichert, M., Herbst, J.: A new paradigm for the enactment and dynamic adaptation of data-driven process structures. In: CAiSE'08, *LNCS*, vol. 5074, pp. 48–63. Springer (2008)
228. Müller, D., Reichert, M., Herbst, J., Köntges, D., Neubert, A.: COREPRO-Sim: A tool for modeling, simulating and adapting data-driven process structures. In: 6th Int'l Conf. on Business Process Management (BPM'08 Demonstrations), no. 5240 in LNCS, pp. 394–397. Springer (2008)
229. Müller, D., Reichert, M., Herbst, J., Poppa, F.: Data-driven design of engineering processes with COREPRO-modeler. In: 16th IEEE Int'l Workshops on Enabling Technologies: Infrastructure for Collaborative Enterprises (WETICE 2007), pp. 376–378. IEEE Computer Society Press (2007)
230. Müller, R.: Event-oriented dynamic adaptation of workflows. Ph.D. thesis, University of Leipzig, Germany (2002)
231. Müller, R., Greiner, U., Rahm, E.: AgentWork: A workflow system supporting rule–based workflow adaptation. Data & Knowledge Engineering **51**(2), 223–256 (2004)
232. Müller, R., Rahm, E.: Dealing with logical failures for collaborating workflows. In: Proc. Int'l Conf. in Cooperative Information Systems (CoopIS'00), pp. 210–223. Eilat (2000)
233. Mutschler, B., Reichert, M., Bumiller, J.: Unleashing the effectiveness of process-oriented information systems: Problem analysis, critical success factors and implications. IEEE Trans. on Systems, Man, and Cybernetics **38**(3), 280–291 (2008)

(c) Springer-Verlag, Berlin Heidelberg, 2012 BOOK PREVIEW

234. Mutschler, B., Weber, B., Reichert, M.: Workflow management versus case handling - results from a controlled software experiment. In: Proc. SAC'08, pp. 82–89 (2008)
235. Nagl, C., Rosenberg, F., Dustdar, S.: Vidre - a distributed service-oriented business rule engine based on ruleml. In: Proc. 10th IEEE Int'l Enterprise Distributed Object Computing Conf. (EDOC 2006), pp. 35–44. IEEE Computer Society (2006)
236. Namiri, K., Stojanovic, N.: Pattern-based design and validation of business process compliance. In: Proc. 15th Int. Conf. Coop. Inf. Systems (CoopIS'07), pp. 59–76. Springer (2007)
237. OASIS: Web Services Business Process Execution Language Version 2.0 (2007)
238. Oberleitner, J., Rosenberg, F., Dustdar, S.: A lightweight model-driven orchestration engine for e-services. In: TES, pp. 48–57 (2005)
239. Ohno, T.: Toyota Production System. Productivity Press (1988)
240. Opdyke, W.F.: Refactoring: A program restrucuring aid in designing object-oriented application frameworks. Ph.D. thesis, Univ. of Illinois (1992)
241. Ouyang, C., Dumas, M., van der Aalst, W.M.P., ter Hofstede, A.H.M., Mendling, J.: From business process models to process-oriented software systems. ACM Trans. Softw. Eng. Methodol. **19**(1) (2009)
242. Pande, P., Neuman, R., Cavanagh, R.: The Six Sigma Way: How GE, Motorola, and Other Top Companies are Honing Their Performance. Mc-Graw Hill (2000)
243. Peleg, M., Somekh, J., Dori, D.: A methodology for eliciting and modeling exceptions. J. of Biomedical Informatics **42**, 736–747 (2009)
244. Pesic, M.: Constraint-based workflow management systems: Shifting control to users. Ph.D. thesis, Eindhoven University of Technology (2008)
245. Pesic, M., Schonenberg, M.H., Sidorova, N., van der Aalst, W.M.P.: Constraint-based workflow models: Change made easy. In: Proc. CoopIS'07, pp. 77–94 (2007)
246. Pichler, P., Weber, B., Zugal, S., Pinggera, J., Mendling, J., Reijers, H.A.: Imperative versus declarative process modeling languages: An empirical investigation. In: Proc. ER-BPM '11, pp. 383–394 (2011)
247. Polyvyanyy, A., García-Bañuelos, L., Dumas, M.: Structuring acyclic process models. In: BPM, pp. 276–293 (2010)
248. Poppendieck, M., Poppendieck, T.: Implementing Lean Software Development: From Concept to Cash. Addison-Wesley (2006)
249. Pryss, R., Tiedeken, J., Kreher, U., Reichert, M.: Towards flexible process support on mobile devices. In: CAiSE Forum, *LNBIP*, vol. 72, pp. 150–165. Springer (2010)
250. Puhlmann, F.: Soundness verification of business processes specified in the pi-calculus. In: OTM Confs (1), pp. 6–23 (2007)
251. van Dongen abd R. M. Dijkman, B.F., Mendling, J.: Measuring similarity between business process models. In: Proc. CAISE'08, pp. 450–464 (2008)
252. Rao, J., Su, X.: A survey of automated web service composition methods. In: SWSWPC, pp. 43–54 (2004)
253. Redding, G.M., Dumas, M., ter Hofstede, A.H.M., Iordachescu, A.: A flexible, object-centric approach for business process modelling. Service Oriented Computing and Applications pp. 1–11 (2009)
254. Redding, G.M., Dumas, M., ter Hofstede, A.H.M., Iordachescu, A.: Transforming object-oriented models to process-oriented models. In: Proc. BPM'07 Workshops, LNCS 4928, pp. 132–143 (2007)
255. Regev, G., Soffer, P., Schmidt, R.: Taxonomy of flexibility in business processes. In: BPMDS (2006)
256. Reichert, M.: Dynamische Ablaufänderungen in Workflow-Management-Systemen. Ph.D. thesis, University of Ulm (2000). (in German)
257. Reichert, M.: What BPM technology can do for healthcare process support. In: 13th Conf. on Artificial Intelligence in Medicine (AIME'11), no. 6747 in LNAI, pp. 2–13. Springer (2011)
258. Reichert, M., Bassil, S., Bobrik, R., Bauer, T.: The Proviado access control model for business process monitoring components. Enterprise Modelling and Information Systems Architectures **5**(3), 64–88 (2010)

(c) Springer-Verlag, Berlin Heidelberg, 2012 BOOK PREVIEW

259. Reichert, M., Bauer, T., Dadam, P.: Enterprise-wide and cross-enterprise workflow-management: Challenges and research issues for adaptive workflows. In: Enterprise-wide and Cross-enterprise Workflow Management, *CEUR Workshop Proceedings*, vol. 24, pp. 56–64. CEUR-WS.org (1999)
260. Reichert, M., Dadam, P.: A framework for dynamic changes in workflow management systems. In: Proc. 8th Int'l Workshop on Database and Expert Systems Applications, pp. 42–48 (1997)
261. Reichert, M., Dadam, P.: ADEPT$_{flex}$ – supporting dynamic changes of workflows without losing control. Journal of Intelligent Information Systems **10**(2), 93–129 (1998)
262. Reichert, M., Dadam, P.: Enabling adaptive process-aware information systems with ADEPT2. In: J. Cardoso, W.M.P. van der Aalst (eds.) Handbook of Research on Business Process Modeling, pp. 173–203. Information Science Reference, Hershey, New York (2009)
263. Reichert, M., Dadam, P., Bauer, T.: Dealing with forward and backward jumps in workflow management systems. Software and System Modeling **1**(2), 37–58 (2003)
264. Reichert, M., Dadam, P., Rinderle-Ma, S., Jurisch, M., Kreher, U., Goeser, K.: Architectural principles and components of adaptive process management technology. In: Process Innovation for Enterprise Software, pp. 81–97. Koellen-Verlag (2009)
265. Reichert, M., Dadam, P., Rinderle-Ma, S., Lanz, A., Pryss, R., Predeschly, M., Kolb, J., Ly, L.T., Jurisch, M., Kreher, U., Göser, K.: Enabling Poka-Yoke workflows with the AristaFlow BPM Suite. In: CEUR Proc. of the BPM'09 Demonstration Track, Business Process Management Conf 2009 (BPM'09) (2009)
266. Reichert, M., Hensinger, C., Dadam, P.: Supporting adaptive workflows in advanced application environments. In: Proc. Workshop on Workflow Management Systems (EDBT'98), pp. 100–109. Valencia, Spain (1998)
267. Reichert, M., Kolb, J., Bobrik, R., Bauer, T.: Enabling personalized visualization of large business processes through parameterizable views. In: 9th Enterprise Engineering Track at 27th ACM Symposium On Applied Computing (SAC'12), pp. 1653–1660. ACM Press (2012)
268. Reichert, M., Kuhn, K., Dadam, P.: Prozessreengineering und -automatisierung in klinischen Anwendungsumgebungen. In: Proc. 41. Jahrestagung (GMDS '96), pp. 219–223. Bonn (1996)
269. Reichert, M., Rechtenbach, S., Hallerbach, A., Bauer, T.: Extending a business process modeling tool with process configuration facilities: The Provop demonstrator. In: BPM Demos, *CEUR Workshop Proceedings*, vol. 489. CEUR-WS.org (2009)
270. Reichert, M., Rinderle, S., Dadam, P.: ADEPT workflow management system: Flexible support for enterprise-wide business processes. In: Proc. Int'l Conf. on Business Process Management (BPM'03), *Lecture Notes in Computer Science*, vol. 2678, pp. 370–379. Springer (2003)
271. Reichert, M., Rinderle, S., Dadam, P.: On the common support of workflow type and instance changes under correctness constraints. In: Proc. Int'l Conf. on Cooperative Information Systems (CoopIS'03), LNCS 2888, pp. 407–425. Catania, Italy (2003)
272. Reichert, M., Rinderle, S., Kreher, U., Dadam, P.: Adaptive process management with ADEPT2. In: Proc. ICDE'05, pp. 1113–1114 (2005)
273. Reichert, M., Rinderle-Ma, S., Dadam, P.: Flexibility in process-aware information systems. In: K. Jensen, W.M.P. van der Aalst (eds.) Transactions on Petri Nets and Other Models of Concurrency II, *LNCS*, vol. 5460, pp. 115–135. Springer Berlin / Heidelberg (2009)
274. Reijers, H.A.: Design and Control of Workflow Processes: Business Process Management for the Service Industry. Springer (2003)
275. Reijers, H.A., van der Aalst, W.M.P.: The effectiveness of workflow management systems: Predictions and lessons learned. Int'l Journal of Information Management **25**(5), 458–472 (2005)
276. Reijers., H.A., Liman, S., van der Aalst, W.M.P.: Product-based workflow design. Management Information Systems **20**(1), 229–262 (2003)
277. Reijers, H.A., Mendling, J., Dijkman, R.M.: Human and automatic modularizations of process models to enhance their comprehension. Information Systems **36**(5), 881 – 897 (2011)

(c) Springer-Verlag, Berlin Heidelberg, 2012 BOOK PREVIEW

278. Reijers, H.A., Rigter, J.H.M., van der Aalst, W.M.P.: The Case Handling Case. Int'l Journal Cooperative Information Systems **12**(3), 365–392 (2003)
279. Reinhartz-Berger, I., Soffer, P., Sturm, A.: Organisational reference models: supporting an adequate design of local business processes. Int. J. Business Process Integration and Management **4**(2), 134–149 (2009)
280. Reinhartz-Berger, I., Soffer, P., Sturm, A.: Extending the adaptability of reference models. IEEE Transactions on Systems, Man, and Cybernetics, Part A **40**(5), 1045–1056 (2010)
281. Reuter, A., Schwenkreis, F.: ConTracts - a low-level mechanism for building general-purpose workflow management-systems. IEEE Data Eng. Bull. **18**(1), 4–10 (1995)
282. Reuter, C., Dadam, P., Rudolph, S., Deiters, W., Trillsch, S.: Guarded process spaces (GPS): A navigation system towards creation and dynamic change of healthcare processes from the end-user's perspective. In: Proc. BPM'11 Workshops, 4th Int'l Workshop on Process-oriented Information Systems in Healthcare (ProHealth'11), LNBIB. Springer (2011)
283. Rinderle, S.: Schema evolution in process management systems. Ph.D. thesis, University of Ulm (2004)
284. Rinderle, S., Jurisch, M., Reichert, M.: On deriving net change information from change logs - the deltalayer-algorithm. In: Proc. 12th Conf. Datenbanksysteme in Business, Technologie und Web (BTW'07), no. P-103 in Lecture Notes in Informatics (LNI), pp. 364–381 (2007)
285. Rinderle, S., Kreher, U., Lauer, M., Dadam, P., Reichert, M.: On representing instance changes in adaptive process management systems. In: Proc. WETICE'06 Workshops, pp. 297–304 (2006)
286. Rinderle, S., Reichert, M.: On the controlled evolution of access rules in cooperative information systems. In: Proc. 13th Int'l Conf. on Cooperative Information Systems (CoopIS'05), no. 3760 in LNCS, pp. 238–255. Springer (2005)
287. Rinderle, S., Reichert, M.: Data-driven process control and exception handling in process management systems. In: Proc. 18th Int'l Conf. on Advanced Information Systems Engineering (CAiSE'06), no. 4001 in LNCS, pp. 273–287. Springer (2006)
288. Rinderle, S., Reichert, M., Dadam, P.: Evaluation of correctness criteria for dynamic workflow changes. In: Proc. Int'l Conf. on Business Process Management (BPM'03), *Lecture Notes in Computer Science*, vol. 2678, pp. 41–57. Springer (2003)
289. Rinderle, S., Reichert, M., Dadam, P.: Correctness criteria for dynamic changes in workflow systems – a survey. Data and Knowledge Engineering **50**(1), 9–34 (2004)
290. Rinderle, S., Reichert, M., Dadam, P.: Disjoint and overlapping process changes: Challenges, solutions, applications. In: Proc. Int'l Conf. on Cooperative Information Systems (CoopIS'04), LNCS 3290, pp. 101–120. Agia Napa, Cyprus (2004)
291. Rinderle, S., Reichert, M., Dadam, P.: Flexible support of team processes by adaptive workflow systems. Distributed and Parallel Databases **16**(1), 91–116 (2004)
292. Rinderle, S., Reichert, M., Dadam, P.: On dealing with structural conflicts between process type and instance changes. In: Proc. BPM'04, *LNCS*, vol. 3080, pp. 274–289. Springer, Potsdam (2004)
293. Rinderle, S., Reichert, M., Jurisch, M., Kreher, U.: On representing, purging, and utilizing change logs in process management systems. In: Proc. BPM'06, *LNCS*, vol. 4102, pp. 241–256. Springer (2006)
294. Rinderle, S., Weber, B., Reichert, M., Wild, W.: Integrating process learning and process evolution – a semantics based approach. In: Proc. BPM'05, *LNCS*, vol. 4102, pp. 252–267. Springer (2005)
295. Rinderle, S., Wombacher, A., Reichert, M.: Evolution of process choreographies in dychor. In: Proc. 14th Int'l Conf. on Cooperative Information Systems (CooplS'06), no. 4275 in LNCS, pp. 273–290. Springer (2006)
296. Rinderle, S., Wombacher, A., Reichert, M.: On the controlled evolution of process choreographies. In: Proc. 22nd Int'l Conf. on Data Engineering (ICDE'06), p. #124. IEEE Computer Society Press (2006)
297. Rinderle-Ma, S.: Data flow correctness in adaptive workflow systems. EMISA Forum **29**(2), 25–35 (2009)

(c) Springer-Verlag, Berlin Heidelberg, 2012 BOOK PREVIEW

298. Rinderle-Ma, S., Reichert, M.: A formal framework for adaptive access control models. In: Journal of Data Semantics, IX, *LNCS*, vol. 4601, pp. 82–112 (2007)
299. Rinderle-Ma, S., Reichert, M.: Comprehensive life cycle support for access rules in information systems: The CEOSIS project. Enterprise Information Systems **3**(3), 219–251 (2009)
300. Rinderle-Ma, S., Reichert, M.: Advanced migration strategies for adaptive process management systems. In: Proc. 12th IEEE Conf on Commerce and Enterprise Computing (CEC' 10), pp. 56–63. IEEE (2010)
301. Rinderle-Ma, S., Reichert, M., Weber, B.: On the formal semantics of change patterns in process-aware information systems. In: Proc. ER'08, *LNCS*, vol. 5231, pp. 279–293. Springer (2008)
302. Rinderle-Ma, S., Reichert, M., Weber, B.: Relaxed compliance notions in adaptive process management systems. In: Proc. ER'08, *LNCS*, vol. 5231, pp. 232–247. Springer (2008)
303. Rolland, C.: A comprehensive view of process engineering. In: Proc. CAiSE'98, pp. 1–24 (1998)
304. Rosemann, M., van der Aalst, W.M.P.: A configurable reference modelling language. Information Systems **32**(1), 1–23 (2005)
305. Rozinat, A., van der Aalst, W.M.P.: Decision mining in prom. In: Business Process Management, pp. 420–425 (2006)
306. Rozinat, A., van der Aalst, W.M.P.: Conformance checking of processes based on monitoring real behavior. Information Systems **33**(1), 64–95 (2008)
307. Rupietta, W.: Workparty - business processes and workflow management. In: P. Bernus, K. Mertins, G. Schmidt (eds.) Handbook on Architectures of Information Systems, Int'l Handbooks Information System, pp. 569–589. Springer Berlin Heidelberg (2006)
308. Russell, N., van der Aalst, W.M.P., ter Hofstede, A.H.M.: Exception handling patterns in process-aware information systems. In: Proc. CAiSE'06, pp. 288–302 (2006)
309. Russell, N., van der Aalst, W.M.P., ter Hofstede, A.H.M.: Exception handling patterns in process-aware information systems. Tech. Rep. BPM Center Report BPM-06-04, BPMcenter.org (2006)
310. Russell, N., ter Hofstede, A.H.M., van der Aalst, W.M.P., Mulyar, N.: Workflow control-flow patterns: A revised view. Tech. Rep. BPM-06-22, BPMcenter.org (2006)
311. Russell, N., ter Hofstede, A.H.M., Edmond, D., van der Aalst, W.M.P.: Workflow data patterns. Tech. Rep. FIT-TR-2004-01, Queensland Univ. of Techn. (2004)
312. Russell, N., ter Hofstede, A.H.M., Edmond, D., van der Aalst, W.M.P.: Workflow resource patterns. Tech. Rep. WP 127, Eindhoven Univ. of Technology (2004)
313. Sadiq, S., Governatori, G., Naimiri, K.: Modeling control objectives for business process compliance. In: Proc. of the 5th Int'l Conf. on Business Process Management, *LNCS*, vol. 4714, pp. 149–164. Springer (2007)
314. Sadiq, S., Marjanovic, O., Orlowska, M.: Managing change and time in dynamic workflow processes. Int. J Cooperative Information Systems **9**(1&2), 93–116 (2000)
315. Sadiq, S., Orlowska, M.: On capturing exceptions on workflow process models. In: Proc. BIS'2000, pp. 3–19 (2000)
316. Sadiq, S., Orlowska, M., Sadiq, W., Schulz, K.: When workflows will not deliver: The case of contradicting work practice. In: BIS (2005)
317. Sadiq, S., Sadiq, W., Orlowska, M.: Pockets of flexibility in workflow specifications. In: Proc. ER'01, pp. 513–526 (2001)
318. Sadiq, S., Sadiq, W., Orlowska, M.: A framework for constraint specification and validation in flexible workflows. Information Systems **30**(5), 349 – 378 (2005)
319. Sadiq, S.W., Orlowska, M.E., Sadiq, W., Foulger, C.: Data flow and validation in workflow modelling. In: Proc. ADC'04, pp. 207–214 (2004)
320. Scheer, A.W.: ARIS. Vom Geschftsprozess zum Anwendungssystem. Springer (2002)
321. Schobbens, P.Y., Heymans, P., Trigaux, J.C.: Feature diagrams: A survey and a formal semantics. In: Requirements Engineering, pp. 136–145 (2006)
322. Schonenberg, H., Mans, R., Russell, N., Mulyar, N., van der Aalst, W.M.P.: Process flexibility: A survey of contemporary approaches. In: CIAO! / EOMAS, pp. 16–30 (2008)

(c) Springer-Verlag, Berlin Heidelberg, 2012 BOOK PREVIEW

323. Schonenberg, H., Weber, B., van Dongen, B.F., van der Aalst, W.M.P.: Supporting flexible processes through recommendations based on history. In: Proc. BPM'08, pp. 51–66 (2008)
324. Schultheiss, B., Meyer, J., Mangold, R., Zemmler, T., Reichert, M.: Designing the processes for chemotherapy treatment in a women's hospital (in german). Tech. rep., Univ. of Ulm (1996)
325. Schuschel, H., Weske, M.: Integrated workflow planning and coordination. In: Database and Expert Systems Applications, *LNCS*, vol. 2736, pp. 771–781. Springer Berlin / Heidelberg (2003)
326. Schuschel, H., Weske, M.: Triggering replanning in an integrated workflow planning and enactment system. In: ADBIS, pp. 322–335 (2004)
327. Sharp, A., McDermott, P.: Workflow modeling: tools for process improvement and application development. Artech House (2001)
328. Sidorova, N., Stahl, C., Trcka, N.: Workflow soundness revisited: Checking correctness in the presence of data while staying conceptual. In: Proc. CAiSE'10, pp. 530–544 (2010)
329. Silver, B.: BPMS watch: Ten tips for effective process modeling (2009). Http://www.bpminstitute.org/articles/article/article/bpms-watch-ten-tips-for-effective-process-modeling.html
330. Silver, B.: Case management: Addressing unique BPM requirements. BPMS Watch pp. 1–12 (2009)
331. Sirin, E., Parsia, B., Wu, D., Hendler, J., Nau, D.: Htn planning for web service composition using shop2. Web Semantics: Science, Services and Agents on the World Wide Web **1**(4), 377 – 396 (2004). Int'l Semantic Web Conf 2003
332. Smirnov, S., Reijers, H.A., Weske, M., Nugteren, T.: Business process model abstraction: a definition, catalog, and survey. Distributed and Parallel Databases **30**(1), 63–99 (2012)
333. Soffer, P.: Mirror, mirror on the wall, can i count on you at all? exploring data inaccuracy in business processes. In: BMMDS/EMMSAD, pp. 14–25 (2010)
334. Song, M., van der Aalst, W.M.P.: Towards comprehensive support for organizational mining. Decision Support Systems **46**(1), 300–317 (2008)
335. Strong, D.M., Miller, S.M.: Exceptions and exception handling in computerized information processes. ACM–TOIS **13**(2), 206–233 (1995)
336. Sun, S.X., Zhao, J.L., Nunamaker, J.F., Sheng, O.R.L.: Formulating the data-flow perspective for business process management. Information Systems Research **17**(4), 374–391 (2006)
337. Swenson, K.D.: Mastering the Unpredictable: How Adaptive Case Management Will Revolutionize the Way That Knowledge Workers Get Things Done. Meghan-Kiffer Press (2010)
338. Trcka, N., van der Aalst, W.M.P., Sidorova, N.: Data-flow anti-patterns: Discovering data-flow errors in workflows. In: CAiSE, pp. 425–439 (2009)
339. United States Code: Sarbanes-oxley act of 2002, pl 107-204, 116 stat 745. Codified in Sections 11, 15, 18, 28, and 29 USC (2002)
340. V. Glabbeek, R., Goltz, U.: Refinement of actions and equivalence notions for concurrent systems. Acta Informatica **37**(4–5), 229–327 (2001)
341. Vanderfeesten, I.: Product-based design and support of workflow processes. Phd thesis, Eindhoven University of Technology (2009)
342. Vanderfeesten, I., Reijers, H.A., van der Aalst, W.M.P.: Product-based workflow support. Information Systems **36**(2), 517–535 (2011)
343. Vanhatalo, J., Voelzer, H., Koehler, J.: The refined process structure tree. Data and Knowledge Engineering **69**(8), 793–818 (2009)
344. Verbeek, E.: Verification of WF–Nets. Ph.D. thesis, Technical University of Eindhoven (2004)
345. Verbeek, H.M.W., Basten, T., van der Aalst, W.M.P.: Diagnosing workflow processes using Woflan. Comput. J. **44**(4), 246–279 (2001)
346. Wagenknecht, A., Rüppel, U.: Improving resource management in flood response with process models and web GIS. In: 16th TIEMS 2009, pp. 141–151 (2009)
347. Waimer, M.: Integration of adaptive process management technology and process mining (in german). Ph.D. thesis, Diploma Thesis, University of Ulm (2006)

(c) Springer-Verlag, Berlin Heidelberg, 2012 BOOK PREVIEW

348. Wainer, J., Bezerra, F., Barthelmess, P.: Tucupi: A flexible workflow system based on overridable constraints. In: Proc. SAC '04, pp. 498–502 (2004)
349. Wainer, J., de Lima Bezerra, F.: Constraint-based flexible workflows. In: CRIWG, pp. 151–158 (2003)
350. Weber, B., Mutschler, B., Reichert, M.: Investigating the effort of using business process management technology: Results from a controlled experiment. Science of Computer Programming **75**(5), 292–310 (2010)
351. Weber, B., Pinggera, J., Zugal, S., Wild, W.: Alaska Simulator Toolset for conducting controlled experiments on process flexibility. In: Information Systems Evolution, *LNBIP*, vol. 72, pp. 205–221. Springer (2011)
352. Weber, B., Reichert, M., Reijers, H.A., Mendling, J.: Refactoring large process model repositories computers and industry. Computers and Industry **62**, 467–486 (2011)
353. Weber, B., Reichert, M., Rinderle-Ma, S.: Change patterns and change support features - enhancing flexibility in process-aware information systems. Data and Knoweldge Engineering **66**(3), 438–466 (2008)
354. Weber, B., Reichert, M., Wild, W.: Case-base maintenance for CCBR-based process evolution. In: Proc. ECCBR'06, *Lecture Notes in Computer Science*, vol. 4106, pp. 106–120. Springer (2006)
355. Weber, B., Reichert, M., Wild, W., Rinderle, S.: Balancing flexibility and security in adaptive process management systems. In: Proc. CoopIS'05, *Lecture Notes in Computer Science*, vol. 3760, pp. 59–76. Springer (2005)
356. Weber, B., Reichert, M., Wild, W., Rinderle-Ma, S.: Providing integrated life cycle support in process-aware information systems. Int'l Journal of Cooperative Information Systems **18**(1), 115–165 (2009)
357. Weber, B., Reijers, H.A., Zugal, S., Wild, W.: The declarative approach to business process execution: An empirical test. In: Proc. CAiSE'09, pp. 470–485 (2009)
358. Weber, B., Rinderle, S., Reichert, M.: Change patterns and change support features in process-aware information systems. In: Proc. CAiSE'07, *Lecture Notes in Computer Science*, vol. 4495, pp. 574–588. Springer (2007)
359. Weber, B., Rinderle, S., Wild, W., Reichert, M.: CCBR–driven business process evolution. In: Proc. ICCBR'05, *Lecture Notes in Computer Science*, vol. 3620, pp. 610–624. Springer (2005)
360. Weber, B., Wild, W., Breu, R.: CBRFlow: Enabling adaptive workflow management through conversational cbr. In: Proc. ECCBR'04, pp. 434–448 (2004)
361. Weber, I., Hoffmann, J., Mendling, J.: Semantic business process validation. In: Proc. 3rd Int. workshop on Semantic Business Process Management (SBPM'08) (2008)
362. Weijters, A.J.M.M., van der Aalst, W.M.P.: Rediscovering workflow models from event-based data using little thumb. Integr. Comput.-Aided Eng. **10**, 151–162 (2003)
363. Weikum, G., J.Schek, H.: Database Transaction Models for Advanced Applications, chap. Concepts and Applications of Multilevel Transactions and Open Nested Transactions. Morgan Kaufmann Publishers (1992)
364. Weske, M.: Flexible modeling and execution of workflow activities. In: Proc. Hawaii Int'l Conf. on System Sciences, pp. 713–722. Hawaii (1998)
365. Weske, M.: Workflow management systems: Formal foundation, conceptual design, implementation aspects. University of Münster, Germany (2000). Habil Thesis
366. Weske, M.: Formal foundation and conceptual design of dynamic adaptations in a workflow management system. In: Proc. Hawaii Int'l Conf on System Sciences (HICSS-34) (2001)
367. Weske, M.: Business Process Management: Concepts, Methods, Technology. Springer (2007)
368. Workflow Management Coalition: Terminology & glossary. Tech. Rep. WFMC-TC-1011, WfMC (1999)
369. Wynn, M.T., Verbeek, H.M.W., van der Aalst, W.M.P., ter Hofstede, A.H.M., Edmond, D.: Business process verification finally a reality. Business Process Management Journal **15**(1), 74–92 (2009)

(c) Springer-Verlag, Berlin Heidelberg, 2012 BOOK PREVIEW

370. Zeng, L., Ngu, A., Benatallah, B., Podorozhny, R., Lei, H.: Dynamic composition and optimization of web services. Distributed and Parallel Databases **24**, 45–72 (2008)
371. Zhao, W., Hauser, R., Bhattacharya, K., Bryant, B.R., Cao, F.: Compiling business processes: untangling unstructured loops in irreducible flow graphs. Int. J. Web Grid Serv. **2**, 68–91 (2006)
372. Zugal, S., Pinggera, J., Weber, B.: Creating declarative process models using test driven modeling suite. In: Proc. CAiSE Forum '11, pp. 1–8 (2011)
373. Zugal, S., Pinggera, J., Weber, B.: The impact of testcases on the maintainability of declarative process models. In: Proc. BPMDS/EMMSAD '11, pp. 163–177 (2011)
374. Zugal, S., Pinggera, J., Weber, B.: Toward enhanced life-cycle support for declarative processes. Journal of Software Maintenance and Evolution: Research and Practice (2011)
375. zur Muehlen, M., Recker, J.: How much language is enough? theoretical and practical use of the business process modeling notation. In: CAiSE, pp. 465–479 (2008)

(c) Springer-Verlag, Berlin Heidelberg, 2012 BOOK PREVIEW