Document-based Dynamic Workflows: Towards Flexible and Stateful Services

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***Abstract*—Task-based workflows describe a set of predefined tasks executed in a predefined sequence flow in which documents representing business objects are sent to activate tasks according to some business goal. The increasingly agile nature of business processes implies that neither the potential tasks nor their sequence flow can be defined a priori. In this context, documents may constitute the central abstraction in a business process execution while services are stateless entities. While business goals and associated business rules drive models and their executions, document content and its structure may additionally be used to determine how the document can be processed and how multiple processing tasks may be composed dynamically.**

This paper introduces a document-based workflow model that implements such agile business processes. The described approach relies on the use of a rule-based system as a means to capture diverse concerns such as business goals and associated rules within a uniform framework. To this end, we illustrate this approach with an electronic health record (*EHR*) application.

***Keywords*-Workflows, Business goal; Document; Constraint**

I. Introduction

Despite being derived from long term strategic business goals, business processes are increasingly executed in dynamic, uncertain, and data centric distributed environments. This involves diverse aspects of workflows and their application domains including changes in tactical business goals and rules, confronting exceptional or new scenarios etc.

A task-based workflow, being an imperative approach, models a series of all possible sequences of tasks (if known) that are executed at runtime by business actors. Constraint-based declarative workflows [1], [2] argue that such exhaustive task specification makes a model over specified with limited flexibility. Similarly, business rules that capture domain expertise and organizational knowledge may also be over specified. However, in agile business scenarios like treating critical patients, managing disasters, all business tasks and rules may not be known a priori due to their individual peculiarities.

Many flexible workflows are proposed to tackle those scenarios and communities [3], [4], [5] develop techniques for flexible workflow management. Some advocate to avoid changes by providing alternative paths [6], [7] or to control execution paths by declarative constraints expressed in LTL formulas [1], [2]. Others allow changes in one execution and/or changing the process model while migrating all current executions [8], [9], [10].

In business processes actors of different business boundaries primarily deal with business documents or portions thereof from their creation to destruction to achieve goals, all such processing being collectively termed as document handling. A document-based workflow (*DocWF*) actor models such processes over tactical goals and functional business rules (FBR) independently of any underlying tasks. FBRs capture domain expertise such as goal precedence. Organizational business rules (OBR) over document content and process models further support in finding suitable tasks/services and as well as their dynamic enactment. In nature these rules are declarative that can be expressed using LTL as in [1] and set boundary constraints over goals and document content. When an actor receives a handled document from another actor, the recipient's OBRs that set constraints on document content are enabled. The role of a *DocWF* system is to assist an actor in her pro-active task enactment to reach goals rather than to instruct her. As such it focuses on what can be the tasks (i.e. *potential task*) to achieve a goal rather than what should be the tasks and their precise succession. A comparison of document-based workflows with traditional workflows (e.g. task-based, declarative and case handling [6]) is reported in the Table I.

Recent industry adoption of SOA-based business process tools and frameworks [11], [12] emphasize the reuse of existing capabilities for which we introduce the notion of organizational *knowledge-base (KB)* that contains existing business process models, their execution history among others. This knowledge is used to determine whether existing tasks/services solve a current business problem. For this, a *KB* must be searchable using for instance semantic tagging of BPMN with goals and documents with concepts as in [13] and [14] respectively.

We believe that a *DocWF* system must support (1) dynamic definition of tasks and their sequence flow and (2) shared understanding of document content amongst distributed actors. Document content and *KB* are utilized in business rule specification for (1) as to either select or define a task for enactment. Also, we model the states (e.g. potentially (not) executable) of these tasks/services at runtime to tackle various runtime exceptions such as service unavailability. A BPEL analogy would be: unlike invoking services in a pre-defined sequence of `<invoke>` elements a *DocWF* system finds suitable services or may define services before invoking. For (2) as we showed in [14], a shared

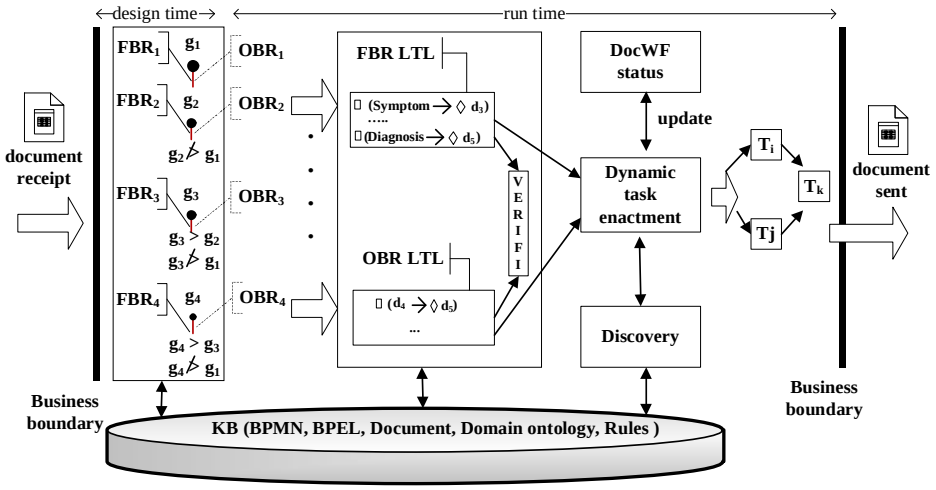


Figure 1. Overview of role played by a *DocWF* system in implementing agile business processes.

ontology of concepts describing the business documents serves as a stable interface among interacting peers and allows their document schemas to evolve. In the rest of the paper, we show how a business user can model such a *DocWF* at design time using goals and FBRs and how the model can be executed by business actors operating in distinct business boundaries.

Section II gives an overview of *DocWF* and followed by a meta-model showing the relationships of different design and run time entities. Section III describes a *DocWF* execution with an illustrative *EHR* document generation example. This also includes design and run time error detection techniques. Section IV positions our work with related literature and finally Section V concludes the paper.

II. A Document-based Workflow (*DocWF*) Model

A. Functional Overview

Fig 1 shows an overview of the envisioned *DocWF* system. A business expert at design time after possibly browsing its *KB*, models tactical goals, their precedence and associated FBR as opposed to modeling tasks and their precise succession. At runtime, upon receipt of a document an actor can define OBR associated to its goals. FBR and OBR being merely constraints make it possible not to specify precise tasks and their sequence flow at design time yet enable task enactment at runtime. These constraints specify restrictions on goals, documents and application specific requirements, for instance, credentials associated to a business process. This model may possibly be shared with all the involved actors.

As Fig 1 shows, it is possible to transform the rules into corresponding LTL formulas which are then represented using automata. Based on the automaton of the rules a *DocWF* model and its execution can be verified by detecting errors such as deadlock and conflicts (cf Section III). The dynamic task enactment component can first find possible tasks/services with the help of a discovery component which performs semantic search in the *KB* as mentioned previously. In case no such tasks/services are found the actor may define/implement the required services. Then the states of these tasks/services are modeled in the *DocWF* status component (cf Section III). Based on the states of executed and *potential tasks* dynamic task enactment is performed which in turn handles associated documents/document portions before sending those to another actor. Note that, the *KB* can be browsed and/or updated (i.e. consultation) at design or runtime.

B. DocWF Meta Model

An object oriented approach in Fig 2 shows the design and runtime entity relationships of a *DocWF* meta-model.

Knowledge-base (KB): A *KB* of an organization is a collection of document semantics (e.g. shared ontology), existing business process models (e.g. BPMN), process execution history (e.g. executed BPEL processes). To enable an actor to consult its *KB* whenever needed, *KB* is not associated to any design or run time entities.

Goal and documents: A *DocWF* system has to achieve a business goal $\mathcal{G}$ from which a set of tactical goals can be derived (i.e. $\mathcal{G} = \{g_1, g_2, ...g_m\}$, for $m \geq 1$). Such goals are abstract definitions of *potential tasks* that will be executed by actors.

Such goals may have causal relationships, meaning one goal may not be achieved before another goal. For two goals g_i and g_j of $\mathcal{G}$ if g_j can not be achieved unless g_i is achieved then g_j succeeds g_i, denoted by $g_j > g_i$.

Let D be a set of documents/document portions d_i denoted by $D = \{d_1, d_2, ..., d_n\}$, for $n \geq 1$, that need to be handled. If d_j can not be handled before d_i then d_i precedes d_j, denoted by $d_j > d_i$. A simple task/service or a composition of tasks/services can be invoked to achieve a goal that implicitly handles documents/document portions.

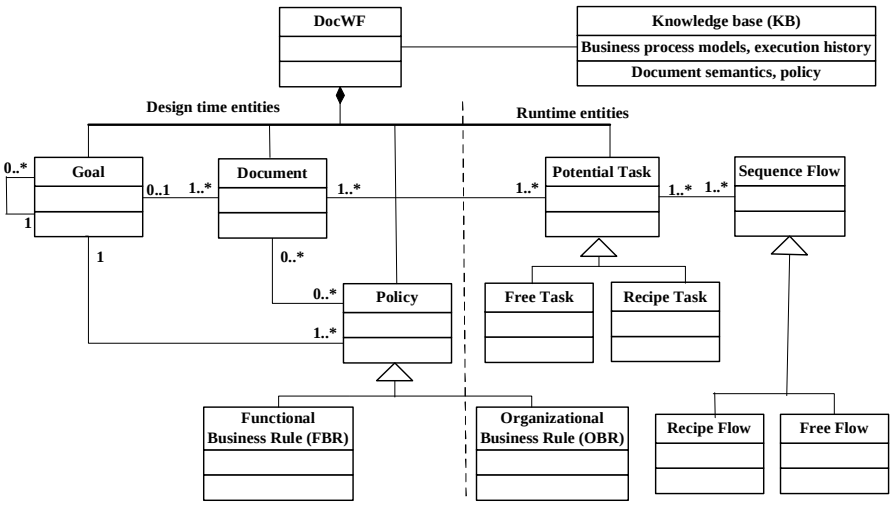


Figure 2. Design and run time entities (separated by a vertical dotted line) of a Document-based Workflow (*DocWF*) meta-model.

The derivation of tactical goals and data instantiation upon a goal achievement are represented by a recursive association of goals that form a goal precedence and another association between goal and document respectively. One goal achievement implicitly enables subsequent goals and documents to be handled until the business goal is achieved. No such precedence between two goals and two documents/document portions are denoted by: $g_j \not\succ g_i$ and $d_j \not\succ d_i$ respectively.

Example 1: In Fig 3 (a), the business goal $\mathcal{G}$ of the *EHR* workflow is to generate a complete *EHR* document D containing patient `<Contact>` d_1, `<HealthInsurance>` d_2, `<Symptoms>` d_3, possible `<DiagnosisTests>` d_4 and `<Treatment>` d_5 data maintained by departments (e.g. administration, pathology, diagnosis, operation theater etc). The derived set of goals is, $\mathcal{G} = \{g_1, g_2, g_3, g_4\}$; with goal precedence $g_4 > g_3 > g_2$ but $g_{[2-4]} \not\succ g_1$ (see Fig 1). A diagnosis result can not be recorded without knowing a symptom. Similarly for a successful treatment record a diagnosis result is required. However, patient's contact and insurance data can be recorded at any time.

Document semantics: An actor can define its individual document data model (e.g. schema) and still maintain interoperability by associating its document instances to shared ontology concepts using OWL [15]. Consider for the *EHR* document, individual departments can share a patient ontology concepts describing relationships of concepts and yet can map those to department's documents/document portions. For instance, a business concept 'treatment' can be mapped to `<Medicine>`, `<Therapy>` and `<Surgery>` related XML fragments of operation theater department (Fig 3 (a)). Such agreed document semantics are a pre-requisite for a *DocWF* system.

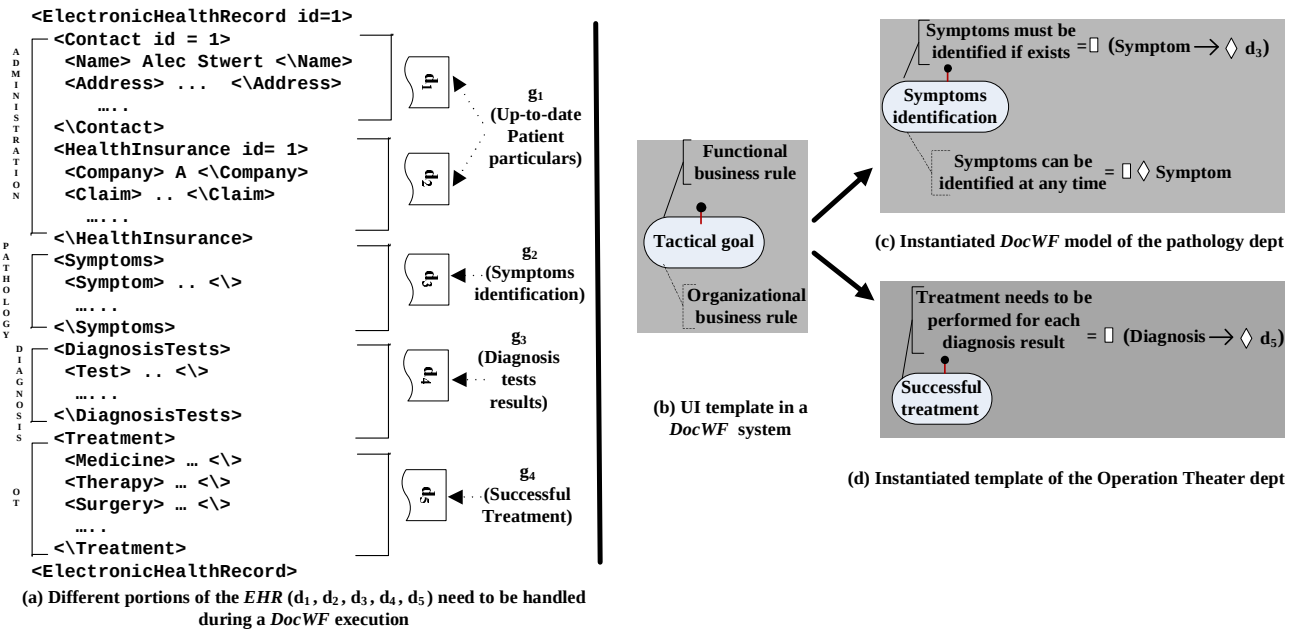
Potential Task: As mentioned before, an actor can define *potential tasks* at runtime. An execution of a *potential task* handles documents which is reflected either by creating new documents or updating existing documents.

Previously defined business tasks in a BPMN model or invoked services in a BPEL model can be reused as returned by the discovery component of Fig 1. The discovery component can for instance match current goals with the semantically annotated BPMN tasks [13] in the *KB*. Such tasks/services and their sequence flows are termed as *recipe tasks* and *recipe flow* respectively.

However, in exceptional situations where no suitable process models or execution history exist in the *KB*, new tasks (i.e. *free tasks*) need to defined and implemented. Their sequence flow (i.e. *free flow*) can be defined utilizing rules (OBR) over the current goals and document content. Consider a doctor orders diagnostic tests for a surgery patient according to a FBR, but cannot wait for the results as patient condition is critical. She may start treatment by providing medicine or therapy following some OBR. As soon as the test results arrive, she might need to achieve a new goal requiring a completely different treatment (i.e. *free tasks*) depending on the result (applying another OBR).

The *recipe* and *free* tasks (and *recipe/free*) are important entities for agile business processes. By finding *recipe tasks* and/or their *recipe flow* of existing business processes of *KB* allows an actor to reuse existing services. If no such tasks/services are found the *free tasks* and *free flow* elements allow her to define tasks and determine their flow at run time by applying business rules.

Policy: A policy base of an organization is formed by functional business rules (FBR) and organizational business rules (OBR). At design time by the usage of domain knowledge, FBR describes functional boundaries and relationships of goals. On the other hand, OBRs may be defined at runtime describing organizational concerns such as expected data in documents, their further processing and desired credentials



(a) Different portions of the *EHR* (d_1, d_2, d_3, d_4, d_5) need to be handled during a *DocWF* execution

(b) UI template in a *DocWF* system

(c) Instantiated *DocWF* model of the pathology dept

(d) Instantiated template of the Operation Theater dept

Figure 3. (a) A fictitious electronic health record (*EHR*) of a patient. (c-d) Instantiated *DocWF* models of (b).

of an actor etc. Note that the goal precedence mentioned before can also be a rule.

As mentioned rules are internally represented as LTL constraints. In terms of later deployment of a *DocWF* system UI templates may be used to abstract such LTL formulas from business actors where each formula is transformed into finite automaton as in [1] (Fig 3 (b)). Transitions to an accepting state of such an automaton satisfies a rule (i.e. *true*) or *false* otherwise. This value may change during the execution meaning a rule that is *false* for the time being may be *true* eventually. Consider Fig 3 (d), for the FBR = 'Treatment needs to be performed for each diagnosis result' the LTL formula $\Box$(Diagnosis$\rightarrow\Diamond d_5$) where 'Diagnosis' and d_5 refer to the associated goal g_3 'Diagnosis test results' and document portion containing treatment data respectively, i.e. each `<Test>` record is eventually has a corresponding `<Treatment>` record. Intuitively, for some diagnosis results corresponding treatment data may not be instantiated at some time but will be filled in d_5 after corresponding successful treatment. In Fig 3 (c), an OBR of the pathology department is 'Symptoms can be identified at any time', i.e. $\Box\Diamond$Symptom which can be *true* after a patient's arrival. Equivalent automata of a FBR and an OBR for the goals g_3 and g_4 are illustrated in Fig 4 (c) and (d) respectively.

III. *DocWF* Process Execution

At runtime, an actor can verify the current model and execution so far before proceeding through suitable task enactment.

A. *DocWF Verification*

For correct execution of a *DocWF* model, it is important that the model does not contain errors and its current execution is correct. One or more rules are enabled at runtime when a corresponding goal is enabled. Errors are detected using automaton of these rules. The execution of a *DocWF* is correct at some point of time if all the constraints representing the rules evaluate to *true*. Similarly, at the end of an execution if all the constraints evaluate to *true*, the execution has completed successfully. Moreover, for no transition in the automaton of the rules for some goals is considered as a deadlock. Also if the automaton has no states and transitions then there is a conflict. A deadlock or a conflict may occur at both modeling and execution time and can be reported to the actors accordingly.

These are illustrated in Fig 4 (a) and (b) respectively. (a) Consider the FBRs 'Symptom identification must be followed by a diagnosis' and 'Symptom identification must not be preceded by a diagnosis record' of the goals g_2 and g_3 respectively. If g_2 is achieved then g_3 can never be achieved as the enabled FBR of g_3 states completely opposite of the corresponding FBR of g_2 and the system would be in deadlock for a design time error. Similarly, a runtime deadlock may occur when the actor specifies an OBR 'All identified symptoms do not need to be diagnosed' that contradicts with the corresponding FBR of g_2. (b) A design time conflict occurs for the OBRs 'At least one diagnosis result must be recorded before proceeding further' and 'Treatment may start at anytime without a diagnosis' of the goals g_3 and g_4 respectively as both rules in combination constitute no states and transitions in the automaton. A

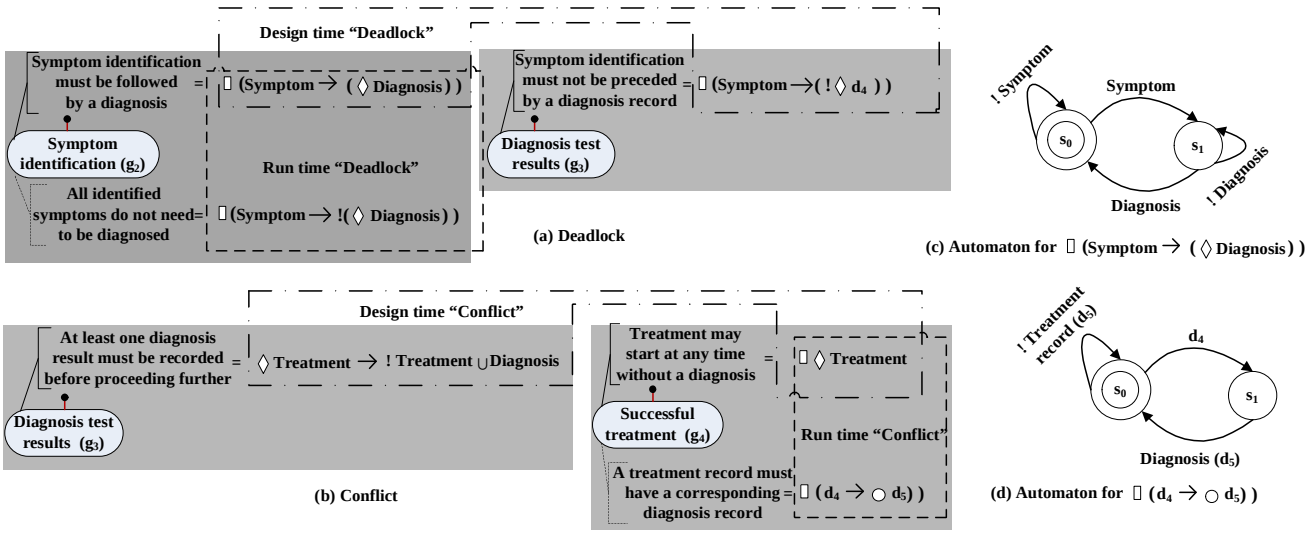


Figure 4. (a) Deadlock between two goals 'Symptom identification' and 'Diagnosis test results'; and functional and organizational business rules. (b) Conflict between two goals 'Successful treatment' and 'Diagnosis test results'; and functional and organizational business rules.

similar situation arises for the FBR and OBR of the goal g_4 at runtime.

B. Task Enactment

A *DocWF* system can find the possible tasks/services by performing a semantic matching of current goals with the corresponding tagging in BPMN models of a *KB*. Such services may not be reachable or unavailable for various reasons for instance communication or system failure. We model the possible states of a task using simple integer values that capture a task's re-usability.

Let T_i be an executed task for a goal g_i for which the associated rule is r_i and r_j be an enabled rule after T_i's execution. A task T_j is a *potential task* after T_i, denoted by $T_j > T_i$ if either (1) both tasks are chosen from the *KB* having same precedence, i.e. $T_j > T_i$ or (2) both r_i and r_j evaluate to *true* (if not *true* yet possibly be *true* later). Similarly, two *potential tasks* T_l and T_m can be executed in parallel if they satisfy (1) and/or (2), denoted by $r_{lm} = 0$ otherwise $r_{lm} = 1$.

A directed graph $G = (T, >)$ represents these precedence relationships, where each *potential task* is a node in the graph and a directed edge from a node T_i to node T_j represents a sequence flow, denoted as $f_{ij} = 1$.

Task state: The state of a task (i.e. executed or potential) T_i, denoted as $S(T_i)$, in a *DocWF* execution is an integer value in $\{0, 1, 2, 3\}$ such that:

- $S(T_i) = 0$, i.e. T_i is *not* executed before and *not* a *potential task*.
- $S(T_i) = 1$, i.e. T_i is *not* executed before and is a *potential task*.
- $S(T_i) = 2$, i.e. T_i was successfully executed before and *not* a *potential task*.
- $S(T_i) = 3$, i.e. T_i was successfully executed before and is a *potential task*.

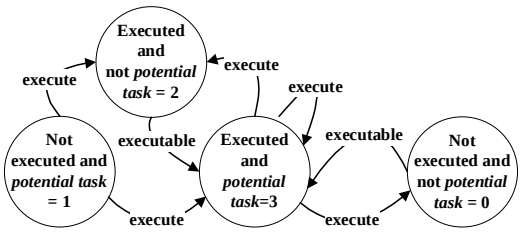


Figure 5. Task state model of the *KB* for enactment.

By the above definition, only those *potential tasks* having a value either 1 or 3 can be executed (see Fig 5). Based on the task state value we define a *DocWF status* that represents current execution status of a *DocWF* system.

DocWF status: A *DocWF status* of a *DocWF* execution is described as an array of the state values of executed tasks. Let S be a *DocWF status* of p executed tasks then $S = \{S(T_1), S(T_2), ..., S(T_p)\}$.

Now, we formally define an execution of a *DocWF* process. An execution of a document-based workflow is a tuple $DocWFexec = (\mathcal{G}, D, T, F, R, S_I, S_F)$, where

1) $\mathcal{G} = \{g_1, g_2, ...g_m\}$, $m \geq 1$, is a set of goals derived from a business goal $\mathcal{G}$.
2) $D = \{d_1, d_2, ..., d_r\}$, $r \geq 1$, is a set of documents/document portions that need to be handled.
3) $T = \{T_1, T_2, ...T_n\}$, $n \geq 1$, is an incremental set of executed tasks where a task is defined as either a *free* or a *recipe* task.
4) $F = [f_{ij}]_{|T|\times|T|}$ is a *sequence flow matrix* of the tasks of T. i.e. $f_{ij} = 1$ if $T_j > T_i$ otherwise $f_{ij} = 0$ for $i = 1, 2, ...|T|$ and $j = 1, 2, ...|T|$.

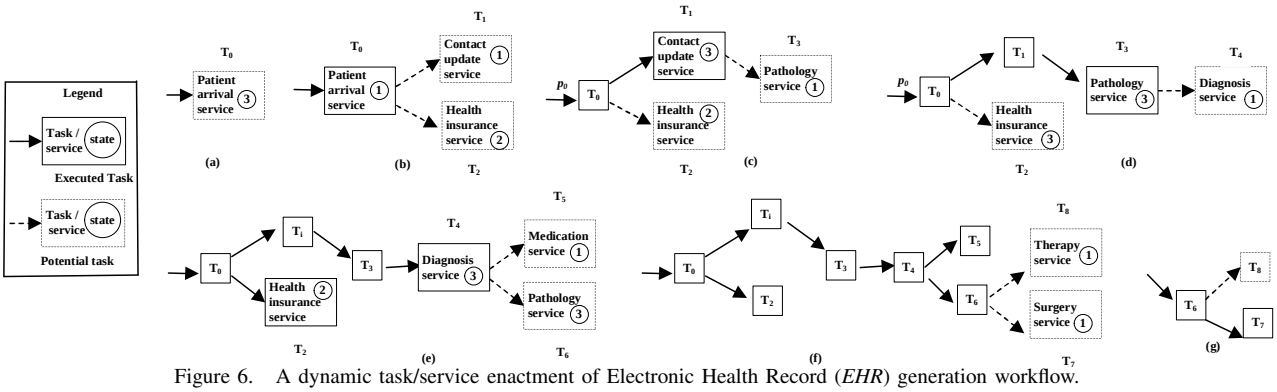


Figure 6. A dynamic task/service enactment of Electronic Health Record (*EHR*) generation workflow.

5) $R = [r_{ij}]_{|T|\times|T|}$ is a *rule violation matrix* of the tasks of T, i.e. $r_{ij} \in \{0, 1\}$ for $i, j = 1, 2, ...|T|$.
6) $S_I \in \{0, 1, 2, 3\}^{|T|}$ is the *initial status* of the *DocWF*.
7) $S_F \in \{2, 3\}^{|T|}$ is the *final status* of the *DocWF*.

In order to provide a comprehensive picture of an execution to an actor, the *DocWF status* component can compute the *DocWFexec* tuple. As an execution goes on T is increased and so are the matrices F and R and all together show the states of executed tasks, their sequence flow and rules applied. Given initial status S_I, for a task $T_j \in T$, if there is no T_i such that $T_j > T_i$, i.e. $f_{ij=0}$ then $S_I(T_j) = 1$; otherwise $S_I(T_j) = 0$. Note that, initial status may consist of state values of executed tasks (i.e. $\{2, 3\}$). As such a *DocWF* execution may start from an unfinished workflow execution as opposed to a task-based workflow which is typically in a blocking situation in case of an exception. On the other hand, in the final status S_F, all the documents/document potions are handled and all the goals and thus the business goal is achieved (implies a *potential task* is executed at least once as denoted by $\{2, 3\}$).

***DocWF Status* Transition Rules:** The dynamic execution of the tasks is governed by a set of transition rules based on which the incremental set of executed tasks T is built. We define general transition rules that take uncertainty and re-usability into account during a *DocWF* execution. For example, in the *EHR* generation workflow (Fig 6 (f)) it is possible to perform additional symptoms tests, i.e. T_6 while doctors are doing medication treatment, i.e. T_5 and can decide dynamically depending on the diagnosis record whether they proceed with therapy or surgery (explained in the latter section). Details of these transition rules can be found in [16].

Knowledge-base (KB) update: A successful execution trace (i.e. sequence flow, executed BPEL), handled document's semantics and associated rules can be added to the *KB* by the actors and thus the *KB* gets continuously enriched for further consultation.

C. A DocWF Task Enactment Example

Assuming no occurrence of modeling and execution error, we now illustrate a dynamic task enactment of the fictitious *EHR* generation workflow by applying dynamic task enactment approach of Section III B (see Fig 6). The actors are hospital administrative employees, pathologists, diagnosis technicians and doctors. Some tasks require human interaction and other can be invoked as automated services. For each transition the *DocWFexec* elements (i.e. executed tasks, handled documents D, *sequence flow* F and *rule violation* matrices R are instantiated. Fig 6 illustrates an execution and the complete instantiation can be found in [16].

Assuming a patient arrival service, i.e. task T_0, triggers the business goal 'Generating a complete *EHR*' (Fig 6(a)). The initial goal g_1, i.e. 'up-to-date patient particulars' with its FBR is 'Separate patient's contact and health insurance data'. For this an OBR refers to the document portion d_1 and d_2 of the administration department and allows parallel updates on d_1 and d_2. Also, a human oriented task i.e. 'Contact update service' (T_1) and an automated service, i.e. 'Health insurance service' (T_2) are found in the *KB* (i.e. *recipe tasks*) for the goal g_1. As the administration employee is available the task T_1 is immediately executable (state 1). However, the 'Health insurance service' is currently unavailable (indicated by state 2) but can be executable as soon as it is available (Fig 6 (b)). The tasks T_1 and T_2 might not need to be performed if the patient was previously admitted in the hospital and as such patient's particulars would have had up-to-date already. This can be determined for instance from a BPEL execution history of the generating *EHR* process in the *KB*.

As the goal g_2 'Symptoms identification' can be achieved independently of the goal g_1, a human oriented 'Pathology service', i.e. pathologists can already record the problem symptoms of the patient, (i.e. task T_3) into d_3 (Fig 6 (c)) as suggested from the *KB*. Note that the state of the executed task T_1 is 3 meaning patient's contact can be updated whenever required.

Now, for the goal g_3 'Diagnosis tests results' an associated

	Task-based Workflow	Declarative Workflow	Case handling [6]	Document-based Workflow (*DocWF*)
Focus	Task	Task	Whole case	Document data, goal
Modeling artifact	Task	Task, constraints	Task	Goal, business rule
Task and Sequence flow definition	A priori	Only task definition	A priori	Dynamic
Primary perspective	Control flow	Constraints over tasks	Case data	Constraints over goals, document data

Table I
DIFFERENCES OF DOCUMENT-BASED WORKFLOWS WITH TASK-BASED, DECLARATIVE AND CASE HANDLING WORKFLOWS.

symptom must be identified in d_3 according to its FBR (of Fig 3 (c)). So, after d_3 is filled in with a symptom data by the task T_3, a diagnosis technician can record the test result by another human oriented service 'Diagnosis service', i.e. T_4 (Fig 6 (d)). Note that the states of task T_3 and T_2 are now 3 meaning symptom identification can occur again and 'Health insurance service' is executable now respectively.

As soon as the diagnosis test results are recorded in d_4, the task T_4's state is changed to 3 that allows more diagnosis records whenever required (Fig 6 (e)). Note that the state of the task T_2 is changed to 2 indicating that service is again unavailable. Now for the goal g_4 'Successful treatment', operation theater has OBRs enabling suitable treatment (e.g. medication, therapy, surgery etc.). The doctor may start treatment, i.e. T_5, by suitable 'Medication'. As the rules of the pathology, diagnosis and the operation theater allow further tests and ongoing according treatment, at a later time the doctor may need some other pathology diagnosis test records before advancing further in the treatment (i.e. T_6). It indicates that the d_4 may need to be handled again while the doctor is performing the treatment i.e. T_5. Now depending on the current test results the doctor may need provide 'Surgery' and/or 'Therapy' services for a successful treatment (Fig 6 (f) (g)).

Now, when the treatment is successfully completed, the *DoCWF* execution will reach a final status by generating a complete *EHR* and thus the business goal is achieved (Fig 6 (g)).

IV. RELATED WORK

Although we are not aware of other proposals which are directly comparable with our approach, many researchers have addressed dynamic and flexible workflow aspects in the last decades that vary diversely. Document oriented workflows proposed in [17], [18], [19], [20], [21] largely follow the task-based approach where [17] focuses on a manufacturing process and [18] demonstrates the usage of XML technology to realize a document and workflow based collaborative system. In line with [18], we developed a secure XML document-based collaboration technique [22], that allows exchanges of fine grained documents among anonymous actors. Upon receipt of such documents, our approach of a *DocWF* can be applied to reach a business goal. X-folders described in [20], trigger a task from a predefined orchestrated tasks depending on a given state of the documents inside a folder.

The authors in [6] proposed a case handling approach to support business processes where each case is handled in isolation (i.e. for each instance). In [1], [2], constraint-based declarative workflows are introduced. Apparently the problem area of case handling and declarative workflows are close to *DocWF* approach for agile business processes. However, case handling still considers the tasks and their sequence flow of a case are specified a priori and declarative approach applies constraints on a set of pre-defined tasks for flexible execution. Our approach is fundamentally different from these as we allow dynamic task definition, its enactment and our rules set constraints on goals and document content. Moreover, they do not consider any semantic approach to enable re-usability of tasks/services. We may also allow constraints on tasks as organizational rules, for instance for a 'successful treatment' a doctor advices a specific medication service due to its previous successful service delivery. Table I points out the main differences of a *DocWF* system with other workflow approaches.

The author in [23] describes a goal oriented workflow modeling technique to generate alternative workflows whenever necessary. Our proposed *DocWF* system differs from that approach in two aspects: (1) unlike the goal of [23] which depends on stakeholders goal, our model supports derivation of subgoals including security goals from a business goal independently of actors involved; (2) a goal achievement is recorded by data instantiation in the documents making a document a stateful representation of a workflow which is not considered at all in [23].

V. CONCLUSION

We proposed a document-based dynamic workflow system that is particularly suitable for agile business processes where required tasks and their sequence flow may need to be decided dynamically. A business actor can model a *DocWF* process utilizing her domain expertise without thinking about precise tasks/services which will be enacted by an actor pro actively at runtime possibly by defining new tasks. The employed business rules set constraints over goals and documents and are expressed as LTL formulas. Such rules treat a *DocWF* execution as goal achievements while a goal can be grounded to one or more task enactments. Utilizing the automaton of these formulas, actors may report modeling and execution errors at design and run time. A problem with such a rule-based system is possible contradiction, in particular when rules are introduced by different actors. However, associating priorities with rules may resolve such contradiction.

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