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State Modeling Methodology for Business Processes

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***Abstract* – In many areas of human activity, process modeling is perceived as a necessity, in some, it is even defined as an integral part of this activity. This fact showed that contemporary approaches to process modeling are, in some cases, not capable of describing the process with all its nuances. This paper defines a new paradigm (and subsequently a new process modeling methodology) that will suitably complement the existing paradigms. This is a state paradigm understanding the process as a transition between states. Such a concept of the process can, in some cases, enable the creation of a model that will better answer the questions asked.**

***Keywords* – state approach, business process, process modeling, state paradigm, BPMN, UML.**

1. Introduction

Business process modeling is perceived as a standard instrument which helps to understand the business process, including its activities, participants, control mechanisms, inputs, and outputs. Proper [1] describes the high-level purposes of enterprise modeling as "understand, assess, diagnose, design, realize, operate and regulate".

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By Batini and Mylopoulos [2], a model can be considered as an abstraction of a domain, which is in line with the purpose of the model. As stated in [3] the selection in which we consider only certain aspects of a modeled domain as an important abstraction flavor. One of the findings presented in [3] is that the definition of language in which the model is represented should be considered to be a part of the model. According to these findings, we can see how the choice of modeling language influences the resulting model and the ability of the model to describe various aspects of a modeled domain.

From the review of the definitions of business process term provided by Lindsay, Downs, and Lunn in [4] it can be seen that most of the definitions of business processes stress out aspects of activities and goals; less often mentioned aspects are inputs and outputs, actors, and information exchange. Detailed review of business process modeling application is given in [5]. In line with previously mentioned findings about the influence of modeling language on the model itself, various modeling languages tend to stress out various aspects of the business process. According to this, we can distinguish the behavioral aspect of a business process that focuses on the activities and control mechanism of the process, the structural aspect of the business process that stresses out the structure of actors involved in the process, and the functional aspect of the business process that stresses out the outputs of the process [6].

2. Materials and Methods

Based on the findings described in Introduction section, the following research questions were formulated:

(Q1) What are the problems of commonly used business process modeling methodologies according to the ability to describe a business process from its various aspects?

(Q2) How can the business process aspects that are missing in the commonly used business process modeling methodologies be incorporated into the business process models?

The second research question (Q2) can be divided into the following two research sub-questions:

(SQ1) Can a new business process modeling methodology that accents the aspects in the business process model be proposed?

(SQ2) Is there a possibility to propose way how to model common aspects of process (decisions etc.) in the state-based modeling methodology?

The paper addresses the specified research questions and sub-questions, and its structure is organized as follows. Section 3 of the paper describes commonly used business process modeling methodologies according to which aspects of a business process they stress out and identify the less accented aspects. Section 4 of the paper presents a state-oriented paradigm that addresses the issues identified in Section 3. Section 5 presents the proposed state-oriented process modeling methodology. Finally, the practical applicability, advantages, and disadvantages of the proposed methodology are discussed and conclusions are presented.

3. Current Business Process Modeling Approaches

3.1. Paradigms

By the approach (or paradigm) of process modeling, we understand the complex philosophy and the way we understand and perceive the process [8]. Each paradigm has its definition of what a process is and what it consists of [6]. These definitions are usually not as strict as mathematical definitions, but provide the information needed to understand the approach. Based on these paradigms, specific methodologies of process modeling are created; their essence is a given paradigm, but the paradigm itself does not present us with a tool for modeling [8].

At present, we can talk about three basic paradigms of process modeling. These paradigms can also be seen as the perspective we use to assess the process [6,9].

Functional paradigm - this paradigm is focused on the functions of the process, inputs, and outputs [8]. The process is understood as a “black box” that works with inputs and generates outputs, all of which can be controlled via control inputs [6]. An example of a methodology based on this paradigm is, for example, the IDEF0 methodology [10]. This methodology works with the concept of ICOM (Inputs, Outputs, Controls, Mechanisms), which contains the aspects described above [11]. Thus, in accordance with the functional principle, the methodology considers a process (or its units, the methodology assumes gradual decomposition into subunits up to the required level [12]) as an object with unknown (at a given level of decomposition) internal structure and behavior that transforms inputs to outputs based on the state of controls and mechanisms [13].

Behavioral paradigm - this paradigm is focused on behavior, on the sequence of activities, on defining the conditions under which the process will run and under which possible variants will be chosen [6]. The process is perceived as a sequence of precisely given activities performed by given roles [8]. This is the most commonly used paradigm. It corresponds to an intuitive view of the process and provides instructions for performing the process (after all, the instructions are described in a behavioral way, as individual subsequent steps). Behaviorally oriented methodologies are, for example, BPMN [7], which has become a certain industry standard, EPC [14], or BORM [15].

Structural paradigm - this paradigm is focused on the structure, the individual participants in the process, on the interrelationships. This paradigm is less used in practice.

Regarding process modeling paradigms, it is important to state two facts:

1. In reality, there is only a given process as a complex entity, and each model is (from the principle of what is a model and modeling) a certain simplification of it, emphasizing those aspects that are important at the moment [6]. The individual paradigms thus represent only certain “perspectives” on a given process. These perspectives should be mutually consistent and complementary as sources of information. At the same time, a new view of working with information that contemporary views do not use or provide is not excluded [6,8].
2. Perspectives are not isolated, i.e. individual methodologies cannot be strictly limited to a given paradigm [6]. Each methodology, although based on a certain paradigm, also contains elements of other paradigms. Thus, for example, BPMN is a behavioral methodology, but also contains, for example, elements of a structural paradigm (for example, entities) [8].

3.2. Problems of Current Paradigms

New perspectives are discussed because it turns out that the current perspectives in many situations are not able to provide the information we need. This is not because these views are wrong, it is because these views have not been constructed to provide the necessary information [6,8]. Specifically, the following gaps have been defined that are not covered by current paradigms:

1. Measurement and evaluation - contemporary paradigms and modeling methodologies based on them describe the process but do not take into account the measurement and evaluation of individual process parameters [16] (examples of such parameters can be, for example, time, finance, other resources, and more). Of course, it is possible to measure these characteristics during the process; however, it is problematic to incorporate them into the process model as immanent components of the process [16].
2. Uncertainty - especially behavioral models work with a fully known and completely deterministic process [9]. Activities must be given exactly, and the individual passes through the process must be determined exactly according to precise conditions [17]. This can be a problem in some cases, as it is not possible to precisely define activities and all variants of the passage in this way.

According to the findings so far, these problems cannot be satisfactorily solved within the current methodologies and paradigms. They require a slightly different angle of view. The state paradigm that will understand the process as a transition between two defined states seems appropriate. It will be possible to perform measurements within the states, and at the same time, the transition will not be strictly defined.

This work presents two basic ways to implement the state principle in the domain of process modeling. The first way is to enrich existing, especially behavioral methodologies with elements of the state paradigm, which was already outlined in [16]. The second way is to propose a new methodology based purely on the state paradigm. Within this part of the work, a case study will be presented showing the possibilities of transforming the process model in a behaviorally oriented methodology into a new state-oriented methodology, including a description of the benefits.

4. State-Oriented Paradigm

4.1. State-Oriented Extensions of Current Methodologies

As already mentioned, the most commonly used paradigm for process modeling is the behavioral paradigm, i.e., the paradigm that considers a process to be a sequence of activities. Methodologies based on this paradigm show the properties also described in the previous section, i.e. it is difficult or impossible to express the need for measurement and evaluation directly in the model, or the inability to express the process with uncertainty [6]. These shortcomings in the strict sense are not shortcomings - methodologies for these purposes have not been constructed, therefore they do not contain adequate tools. Behavioral methodologies serve precisely to unambiguously and clearly described unambiguous and well-arranged processes [8].

During use, there may be a situation where the methodology reaches its limits. If these limits are exceeded only in a small way, it is possible to consider adding new elements to the methodology, which will extend the possibilities of the methodology. This is not new, the BPMN methodology was also evolving from version 1.0 to version 2.0 [18] so there was an expansion of building entities and principles so that it is possible to model complex processes. The current state of the BPMN methodology is, of course, such that the methodology only shares a paradigm with UML [19], i.e. the basic principles.

The extension of behaviorally oriented methodologies by state aspects was outlined in one of the authors' previous publications [16]. This extension brings the introduction of states into a common behaviorally oriented model - it is understandable that, for example, nondeterministic processes cannot be solved in this way; however, measurement and evaluation can be introduced into the process model in a relatively elegant way. Of course, the disadvantage remains that similar DSML (domain-specific modeling language) does not have support in standardly defined process modeling tools [20] as e.g. BPMN [21].

4.2. Pure State Approach for Process Modeling

In Section 4.1., the possibility of extending commonly used behaviorally oriented methodologies was defined. The state approach has expanded the set of information that such a behaviorally oriented model can provide. The common behavioral model provides only information about activities, less about the current state, and what are the values of quantities that we consider important. However, the extended behavioral model is still primarily a behavioral model with all the consequences - the positive ones and the ones we are trying to suppress. These problems of existing process modeling paradigms have been described in more detail in Section 3.2.

For example, it is still assumed that the activities of this process are fully known when modeling the process, which may not be a correct assumption. On the contrary, state characteristics may be the only known aspect of our actions. In such a case, an approach that uses only state characteristics would undoubtedly be appropriate. This state approach must be based on a theoretical definition of state but must also offer an approach that is easy to grasp for the needs of practice (and logically also for the needs of people in practice).

4.3. Definition of Process in the Pure State Approach

State-based processes are processes that are, in principle, state-based, i.e. those in which the goal is to achieve the state and it is not important by what means or through any activities. The basic definition of the process within the state approach is very important. Definition of proces in pure state approach was already outlined in [22]. The framework process definitions for the other approaches are as follows:

- Behavioral approach - A process is a set of activities organized in parts that leads to the desired goal [6], [22].
- Functional approach - A process is a system that generates a given set of outputs for a given set of inputs [8], [22].

Of course, these definitions are not binding but are only general. Many different definitions can be found in the literature (e.g. [6,16]). However, in our opinion, these adequately and concisely present the core of the approach to the process modeling.

A similar framework definition needs to be established for the state approach. It should be noted that this is not a definition in the sense of a mathematical definition. The mathematical definition is exact, rigorous, and every word in the definition has meaning. Our definition serves primarily to understand the approach as such; its wording can be changed. The process in terms of the state approach can then be defined as follows.

- The process is the transition between the initial and final states of the system.

Graphically, this definition can be represented as can be seen in Figure 1.

Figure 1. Philosophy of process in state approach

It is important to realize that it is not the specific wording of the definition in the sense of specific words that is important, but the philosophy itself. The state paradigm understands the process differently than, for example, the behavioral one. Many readers of the model will find it difficult at first to understand that from the point of view of the state paradigm we are really not so much interested in the sequence of activities, but only in the transition between states. On the other hand, we are still dealing with the same process, i.e. process models of the same process (in different paradigms) must be consistent and describe the same situation.

5. State-oriented methodology

Section 4 defined basic concepts and approaches of state understanding of the process. In constructing the methodology for state-oriented process modeling, we will use these concepts. However, the problem of the theory may be its difficult to grasp and difficult to use in practice - this is evidenced by the low expansion of formal methodologies of process modeling within standard approaches.

A practically usable methodology must be based on these theoretical concepts; however, it must be easy to use and must reflect the needs of the practice and the readiness of individual workers. Current methodologies have been applied, especially because they provide notations that can be used without the need to know and understand the complex theory. It is a fact that a lower level of formalization can cause problems in some cases, but the advantages for common use in process modeling outweigh the benefits.

Thus, the theory of states presented in previous publications will serve as an inspiration. We will be guided by the effort to implement this theory into a new approach to process modeling, but also by the effort to present a methodology that does not require extensive theoretical knowledge.

5.1. Graphical Representation of a State

Given that our goal is to define the methodology of process modeling, which will have its graphical representation (diagram), it will be necessary to gradually define the graphical symbols for the individual artifacts of the process model. First, we must logically define the symbol of the state itself. For these purposes, we consider the state descriptor described in the previous section devoted to modifications of traditional behavioral methodologies to be appropriate. Therefore, the following diagram (Figure 2) only graphically repeats the state descriptor symbol.

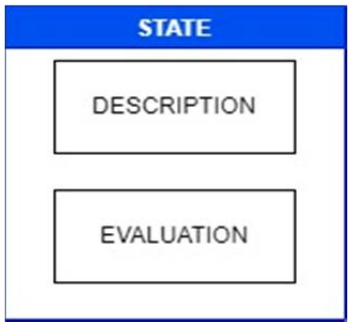

Figure 2. Graphical representation of a state

It can only be recalled that the state descriptor contains the following items:

- State name - user-defined state name;
- Description - a set of properties and their values that define a given state;
- Evaluation - a set of properties that we measure within a given state and possibly compare with reference values. Examples are resources (time, funds, people), but also other characteristics.

Here it is necessary to attach a small note to describe the condition. Of course, a simple description using the values of several defining properties can only be used in the case of a state that is represented by one point of the state space. If the state is given by a state space area, the state can be defined in the "Description" item using intervals of values of defining properties, in the case of an irregular area a simple reference to the state space area, which is defined elsewhere in the model. It is always necessary to follow the goal that is the simplicity and clarity of the diagram.

The principle of evaluation is that when the given state is reached (i.e. the conditions of its defining part are met), the evaluation characteristics are measured. These can, for example, be compared with expected values, or they can be (in the case of multiple instances of the same process) statistically processed.

5.2. Graphical Representation of a Simple Process

The process can then be displayed using the defined graphic symbol for the state as can be seen in Figure 3:

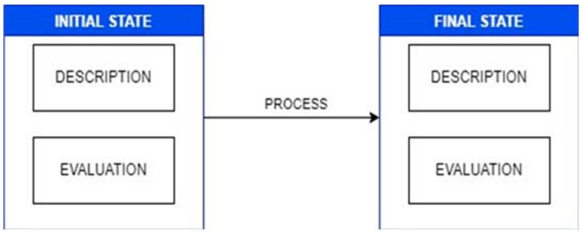

Figure 3. Graphical representation of a process

It is understandable that in the case of a specific process, specific states are defined with a specific description, or then also with specific values of evaluation properties. A simple example is a wedding process. The initial state is the state when the person is single. The final state is then the state when the person in question is married. The transition between these two states is, according to the definition of the process in the state concept, just the wedding - it is not specified how this process will take place. This is logical because a wedding can vary depending on, for example, the country, the church, or the time. The relevant process diagram is shown in Figure 4, where the individual states are already defined by their properties. An evaluation property can be e.g. the wedding expenses.

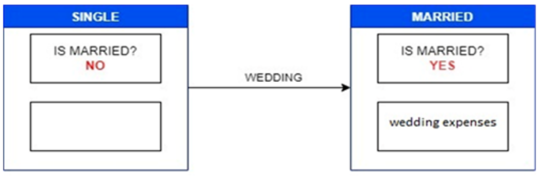

Figure 5. Process with interstate and subprocess.

5.3. Interstates and Subprocesses

The process in the state approach is understood as the transition from the initial state to the final state. This approach is quite general but may be too rough for practice and does not cover important details (important for both description and process evaluation). In this case, it is possible to use interstates, which is a common situation that divides the original process into two parts (or into several parts when using multiple interstates). These parts of the original process are then referred to as subprocesses. Thus, we will understand the subprocess as a logically integral part of the original process, namely the part between the initial state and the interstate, the part between two interstates, or the part between the interstate and the final state. Graphical representation can be seen in Figure 5.

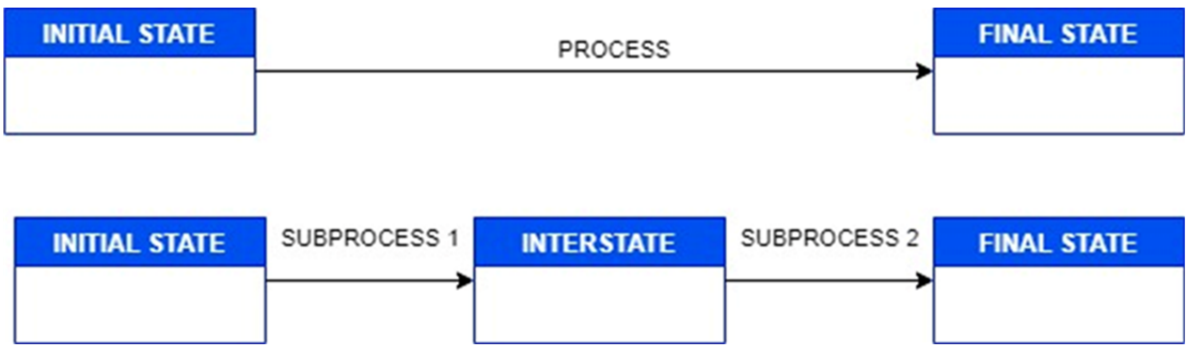

Figure 5. Process with interstate and subprocess

5.4. Homogeneous and Heterogeneous States

The basic, fundamental aspect is the quality and accurate definition of individual states. Although it has already been suggested that for the needs of the practically usable methodology, we will give somewhat to the formal definition of states based on a precisely defined state space, it is necessary to realize that a certain precision in the definition of states is what determines the quality of the model. Thus, we can limit the formalism but not the principled conception of the definition of states. We must be able to specify unambiguously what does it mean that the process is in a certain state. Thus, we understand the state as a set of the values of defining properties (formally as a subset of the state space). Thus, we can say that a given system is in a given state just if the real values of the definition variables are as prescribed for the given state. By analogy, we can also talk about values in a given interval or in short, values that meet a certain characteristic (for example, an index value). We can work with two variants of the approach to the values of definition variables.

Homogeneous states - in this case, it is true that there is a predetermined set of defining variables, while the individual states differ only in the values of these variables.

States thus correspond well to the theoretical definition of a state as a subset of state space; on the other hand, this principle may not always be comfortable for real practice, because it can be difficult to define all states in this way. The states could be shown in the state space diagram. In Figure 6 we see a simple process of changing the marital status - first, the person is single, then after the process of marriage becomes married, then the person can go to divorce state by divorce process (here we ignore the fact that similarly could be defined widowed and that to distinguish it would be necessary extend the set of defining properties).

In all cases, the state is defined by a pair of defining properties (is married and was married).

Heterogeneous states - in this case, different states can be defined using different sets of properties. This may make it easier to define individual states, but this methodology does not fully meet the theoretical definition. In this case, states are often defined using a common language, intuitively. The states could not be shown in the space diagram. In figure 7 we see a simple process of brewing coffee. Each state is described in a common language, and the values of the definition variables are not used directly. However, this process is easy to understand for ordinary use.

For practical use, we must consider how much it is necessary to build process models on formal theoretical foundations. In many cases, this is not necessary, and then it is appropriate to define the states in virtually any way; only it is necessary to always think about the clarity and comprehensibility of the model. Very often the process itself indicates which of the state definition approaches should be **used.**

Where the process is inherently formal, it is also more appropriate to define states more formally. On the contrary, for a process that is less formal and whose description is intended for people with a weaker relationship to formalism, it is appropriate to use a heterogeneous definition using intuitive descriptions.

5.2. Decisions

For each process, there may be situations where, based on external or internal circumstances, there is a decision-making process that defines the further development of the process. This is a characteristic of the process itself, not of the paradigm or methodology. Therefore, the modeling methodology based on the state paradigm must include the possibility of decision-making or process flow control.

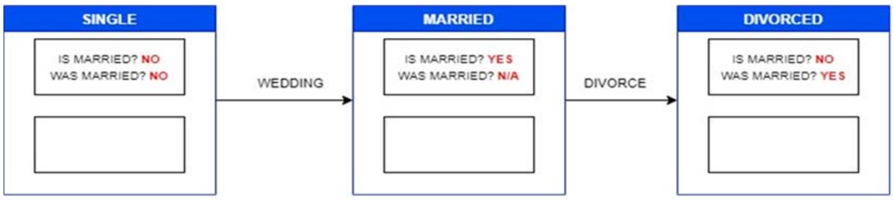

Figure 6. Process with Homogeneous States

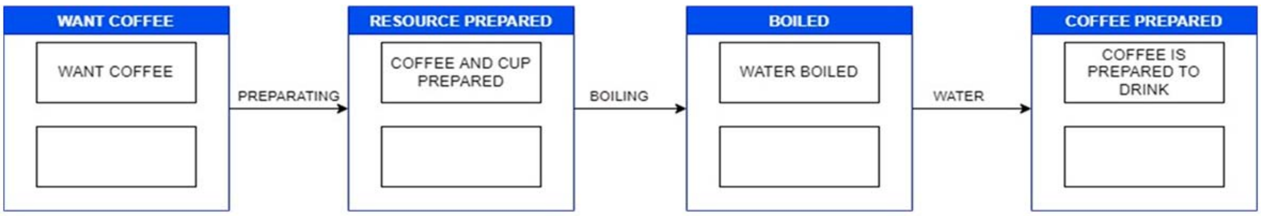

Figure 7. Process with Heterogeneous States

Philosophically, however, the concept of such decision making will be completely different. The reason is the fact that in behaviorally oriented methodologies we decide according to behavioral criteria, which is not possible with the state approach, where we have only state indicators that declare the fact that we are in a state. Decision-making, therefore, means that it is possible to move from a given state to several other states - these transitions are, as already mentioned, called subprocesses. The state paradigm then does not go deeper into the behavioral side of subprocesses. Thus, decision making in the state methodology will be represented by multiple transitions from a given state to more than one subsequent state, as shown in the figure.

This model (Figure 8) is an extended model from the part about homogenous states.

5.3. Mandatory and Optional States

When modeling processes using a methodology based on the state paradigm, we will face the question of whether it is always necessary to consider each state as mandatory, i.e. whether the course of the process presupposes the passage of all states, or whether the final state is always reached. Deeper thinking leads to the clear answer that this may not be the case. Even simple models based on the definition, i.e. that the process is a transition between the initial and final states, can bring about a situation where the final state is not always reached. As an example, we can give a simple example of a study process model, where the initial state is a state in which a person is studying and is not a graduate, while the final state is a state in which a person is no longer studying and is a graduate, as shown in figure 9.

It is obvious that in many cases there is a situation where a person does not graduate, and therefore the final state does not occur - even these processes can be interesting. It is therefore necessary to take into account the possibility in the model to indicate that the final state (or another state) does not necessarily have to be reached without talking that the process (from the point of view of the model) does not correspond.

It is, therefore, necessary for the methodology to include the designation of those states, their nonachievement (and at the same time reachability) means a standard course of the process - for example noncompletion is usually expected, it is a common phenomenon, albeit an unwanted one. Reachability is also important because, especially in more complex models with decision blocks, a state may be already unattainable due to choice (for example, a married person can no longer be single) - in such a state it does not matter whether it is marked as mandatory or optional. Duty or nonobligation is always understood in the given context with regard to reachability. Therefore, we mark the optional states with a green header as shown in Figure 10.

It is necessary to make a note here - intuitively we would understand that the process is not complete, as it could be supplemented by another state, which means just the unsuccessful completion of studies. However, the model must always be understood in the context of what is to be modeled, so it cannot be clearly stated that such a complement is appropriate or necessary. This model was presented only as an example of a mandatory/optional state, if it is a model in practice, it would have to be clear what

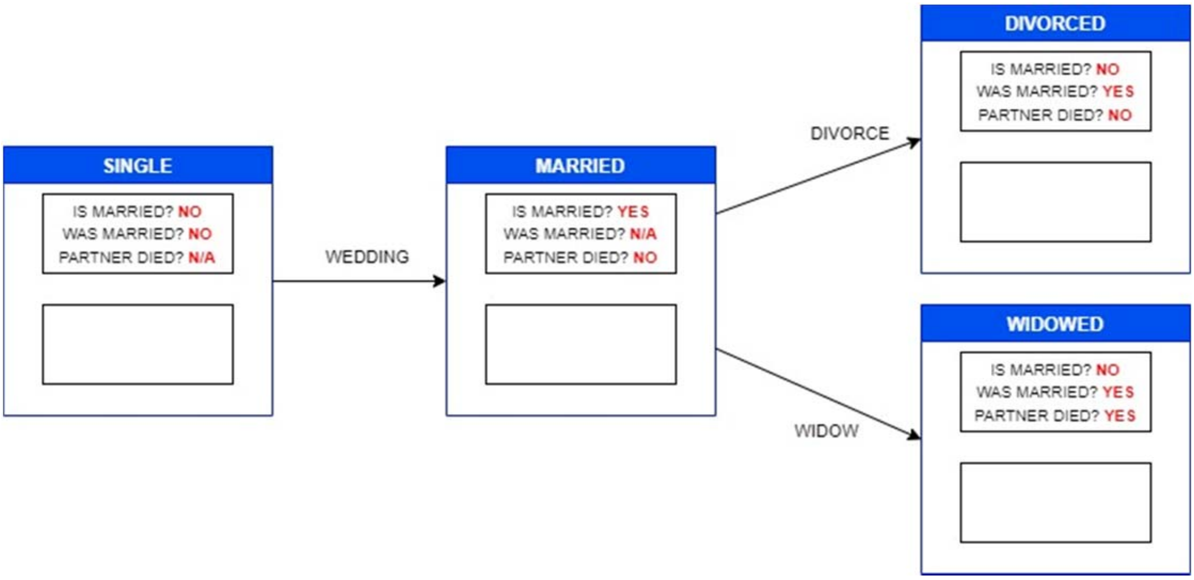

Figure 8. Process with Decision

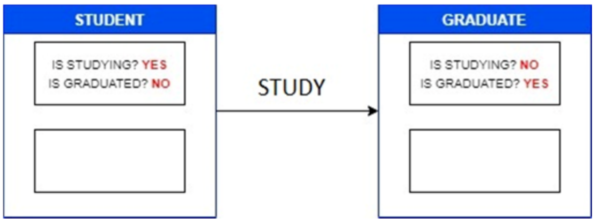

Figure 9. Study Process Model

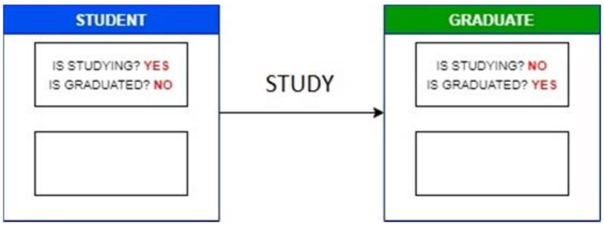

Figure 10. Process with Optional State

situation the model describes and what information it should bring. The context is also important for the mandatory/optional states definition. Even more complex situations may arise for more complex processes and processes with intermediate states. Let us have the situation described in Figure 11.

As the process is now modeled, it is assumed that each participant will reach the destination and that each participant will visit the restaurant for refreshments. However, this may not be the reality, and we must be able to model other situations as well. We have already defined a way to model a situation where one of the states is not mandatory. Therefore, if we want to show a situation where not all participants necessarily reach the destination of the trip, the diagram will look as in Figure 12.

The question remains on how to deal with the intermediate state. There are generally three possible situations here:

1. Interstate is mandatory - or is expected to be reached at each instance of the process - this state is shown now, the state is shown in blue. In the case shown, this situation means that everyone visits the restaurant for refreshments.
2. Interstate is fully optional - in practice, this means that in some instances it is achieved, while in others it is not. Therefore, the state can be completely bypassed and the next state can be continued; alternatively, a direct transition to the next state can be drawn. We will speak of a state that is dispensably optional. In the case shown, this situation means that some people will visit the restaurant on a trip, others will not, and this fact will not affect whether or not they can successfully reach the destination.
3. Interstate is partially optional - in practice, it means that in some instances it is achieved, while in others it is not achieved. However, if the state is not reached, it is not possible to continue. This state cannot be bypassed. We shall speak of a state that is indispensably optional. In the case shown, this situation means that some people do not even go to the restaurant, but this ends the trip for them because, for example, they do not receive a stamp (orienteering).

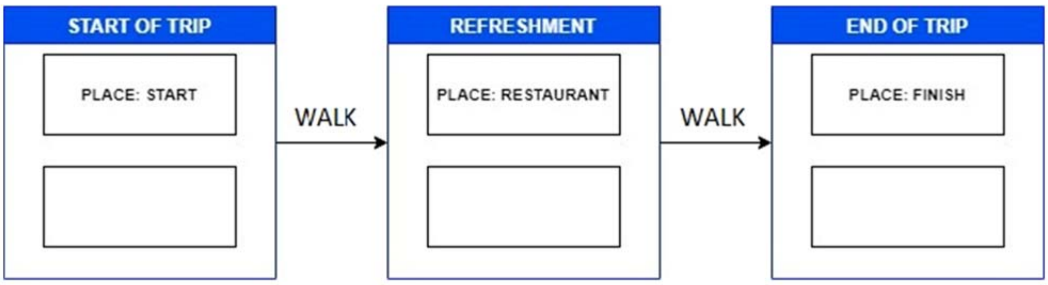

Figure 11. Trip Process - Mandatory States

Figure 12. Trip Process – Optional Final State

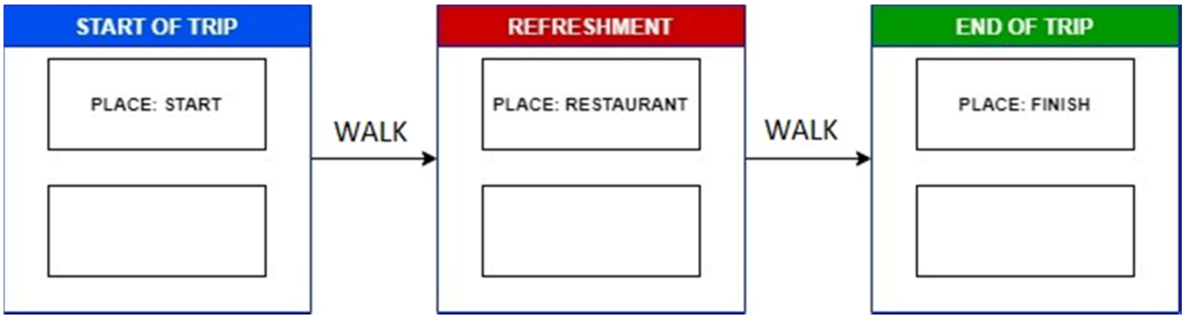

Figure 13. Interstate is Indispensably Optional

It is, therefore, necessary for us to be able to distinguish between two types of optional states - one that is actually optional and can be dropped in the process, and then one that may not be reached, but then this failure means that it is impossible to move on to other states. So let the already defined state marked in green represent the first variant, i.e. the state that can be dropped, and let us introduce another type (marked in red) for the state that cannot be dropped. Figure 13 shows the situation that everyone who will not arrive at the restaurant for refreshments can no longer reach the destination.

Remarks:

1. For the final state, which may not be reached, it does not matter, whether we model it in one way or the other; the final state has no followers. Only if the final state ceases to be the final state within the process transformation will it be necessary to remember whether it is still modeled in the correct way corresponding to reality. This is also true for any revision of the model or process itself.
2. Dispensably optional interstate we can replace so that we physically model the decision where the alternative path will go directly to the following state as can be seen in Figure 14. In some cases, this methodology (which models the same situation) may seem clearer. It is then up to the person creating the model to choose a more appropriate solution at the time.

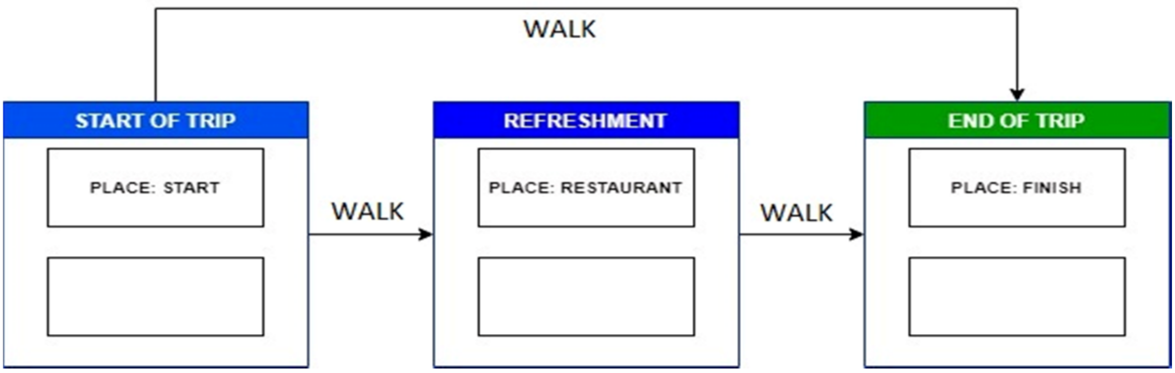

Figure 14. Replacement of optional interstate by additional transition

6. Discussion

In this article, the new concept of process modeling and the specific methodology for practical process modeling was introduced. When we talk about a new concept, then by the term “new” we mean novelty in process modeling. The state principle itself is a tool that has been used successfully for a long time; we can mention the state diagram within UML, or the use of finite state machines. However, the state principle has not yet been used in process modeling.

We see the benefit of this work mainly in the fact that it proposes a pure state approach to process modeling, i.e. an approach that describes the process strictly as a transition between the initial and final states, possibly supplemented by partial intermediate states. No behaviorally oriented building blocks of the model are needed in such a case, and even more so, they would be superfluous and misleading in the state concept. To be able to create real process models and demonstrate on them the usefulness or, conversely, the problems of the state approach, a methodology was proposed.

Although in our opinion the new paradigm and the new methodology may be useful, they are not a substitute for the paradigms and methodologies of the existing ones. We consider them as another possible view of the process, i.e. as a supplement to the views and paradigms of the existing ones. In addition to the commonly used functional, behavioral, and structural paradigms, there is a state paradigm. This, of course, brings new possibilities where it is possible to describe other aspects of the modeled process, but we must also take into account the need to reconcile not only three but four views so that they are really four views of the same thing, in this case the process. Of course, the risk of model inconsistencies increases with the number of views.

Of course, the new methodology always has a major disadvantage that it is not known and that users do not have the knowledge and experience to use it. The lack of software support in major modeling tools is also the barrier of using the methodology. However, these deficiencies are a childhood disease of each new methodology and can be addressed soon. However, the question is what the usability of the methodology itself is. It is necessary to realize that any tool has limits to its use, i.e. a defined area in which its features are such that it satisfies the needs of users. Therefore, it is clear that the state approach has such boundaries and that it is not a universal methodology of process modeling. According to our court, such does not exist and cannot exist in principle - the model is a simplification of reality depending on context or view.

The state approach is suitable in such processes where we either do not know the exact sequence of activities or this sequence is not what we need to describe. Another condition for use is that we can define meaningful states in the process - we can define the state in any way, but for the model, we should define such states that are a real milestone in the process and that have real meaning. Thus, while modeling within a behavioral paradigm is more a matter of describing what happens during the process, the state paradigm requires a higher degree of invention. Of course, many conditions appear almost automatically, but for others, it is more difficult to define.

The article defined the problems of behavioral methodologies, especially the indeterminate activities or the need for evaluation; precisely, the processes containing these aspects are suitable candidates for modeling within the state paradigm. In contrast, models, where we are primarily concerned with capturing the behavioral component (instructions, procedures), will be rather further processed in the traditional way, by current paradigms and methodologies.

7. Conclusion

According to the research question (Q1) we have found two main aspects of a process missing in commonly used business process modeling methodologies. These are “Measurement and Evaluation” and “Uncertainty”. To address the research question (Q2) the state-oriented paradigm of business process modeling was proposed in Section 3 of the paper. Section 4 proposed a business process modeling paradigm based on the state-oriented paradigm according to the first research sub-question (SQ1) and section 5 proposes the way of modeling of common situations like decisions or mandatory and optional states according to second research sub-question (SQ2).

The paper also describes how it is possible to define the area of applicability of the new methodology, especially in the case of processes with unclear activities or state-oriented processes in principle. The proposed state-oriented methodology is an initial version. We have to deal with its refinement and adding expressive options for various situations. Implementing a state-oriented paradigm into commonly used software tools is a necessity, without which modeling can’t be well used in practice.

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