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An algorithm for creating an automated system based on platform of business process

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Abstract

Recent technological advances have enabled the emergence of novel business models based on platforms. This paper aims to contribute to design platforms of business process (BP), by studying the new and specific context of platform to improve the model of platform technology for creating automated system (AS) for BP. Our approach is provides an algorithm to build such a component and enrich future systems. A specific objective is to elicit detailed platform's requirements and features for this particular context. The structure recommendations are determined for business process can bolster various sorts of generative instruments of social communication: data sharing, combination, and aggregate activity. The knowledge generated in this study extends the limits of automated planning of business process, adds more scientific thoroughness for AS with regards to business process the executives and adds to control stream design hypothesis.

Keywords: Business Processes ; Automated System (AS) ; BP Model ; Specialized Processes.

1. Introduction

In today's e-world, where companies and organizations carry out most of their business over the internet, software architectures attempt to deal with the increasing levels of complexity. As the level of complexity continues to ascend, traditional architectures do not seem to be capable of dealing with the current problems such as the need to respond quickly to new requirements and allow better and faster integration of applications in platform [1-2].

Due to the fact that the platform is also a software system, platform design technology is a type of technology for creating software systems. And if the platform is built for the purpose of the AS, then the technology of creating the

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platform coincides with the technology of creating the AS. Developers of platform mostly focused on single design parameters that give users a good reason to join and keep using the platform: notably, the creation of new features and add-ons that attract users [3]. In our case the platform development is carried out in this way. When examining a problem area, it is necessary to establish the directions in the series of the problem area that are most unstable or changeable in different instances of the problem area class. Services are created to take account the individual characteristics of the instances. Then the process of building an automation system for individual instances of a problem area based on platforms is reduced to combining the software (small integration) of the platform with the necessary services.

The following is a definition of common properties or parameters for all instances of the problem area. Based on the general properties of the problem area, the core of the platform should be built [4]. Based on our findings, we will sketch a guiding an algorithm for creating an automated system based on platform of business process.

2. Algorithm for creating platform based systems

The process of creating a system by the platform begins according to the requests submitted to the platform by the actor (s), which includes the terms of reference. According to the application received, a feature vector is determined that characterizes the future system being created. The signs of the future system are contained in the application or they are formed by the platform during the processing of the application (see Fig. 1).

Thus, the application consists of sections: tasks for creating a class of BPMS systems, technical task, feature vector. The application task section contains information about which system should be built - this acts as a goal, signs are needed to assess the complexity and cost of the future system. The technical task section contains data on what functional qualities from the point of view of system consumers, i.e. user requirements must be met. Preliminary work on this can be found in [5-6]

At the platform application level, by a feature vector, a system similar in features is searched. If there is no such model, then the system metamodel is built in the core.

After receiving the application, the next step is searching among applications recorded and stored systems for a system that meets the requirements of the application. It is pre-formalized by a set of features and the systems are also formalized by features. If the conditions for equality are fulfilled for the relevant features, then it is considered that the system is found that satisfies the requirements of the applications. If no finished system is found, then it is necessary to build a system for applications. To do this, in the core of the platform for the business process (based on the business process) we will build a system that reflects the logic of the system's action on BPMN / BPEL. Then, for the BPEL service nodes, we define the WSDL of the services. For one business process, we will build one BPEL model and service.

Then the type of business process is determined, highlight business processes and determine their boundaries. Because business processes are an integrating tool of all production elements (components) necessary to achieve a goal or its purpose. Both the verification of business processes and the definition of business processes are based on a semantic analysis of the application submitted.

Next, it is necessary to formulate the tasks of automating business processes taking into account their parameters and components. Based on the results of the analysis of applications, solutions will be selected by templates, i.e. selection of the necessary features for each specialized process. The process template consists of the logical part and set of services that are performed depending on the execution conditions for the parameters characterizing the characteristics of the subject, the means of labor, as well as the production environment, which are presented as part of the ontological environment model and are part of the EPI.

The next step is the formation of the logic of a specialized process, and then the logic of the complete process.

The formation of the logic of specialized processes as part of a business process is carried out in the following sequence: administrative, organizational, managerial, technological, providing resources, service based on UDDi.

Next-to-last stage is the calculation of the plan and schedule using services.

As a result, we obtain in the form of an answer the sequence of ordered business operations that we need and the parameter values are determined.

An expanded view of the business process model can be achieved based on the multidimensional concept of business processes

The functioning of the platform is based on a specific model of representing business processes. Therefore, it is necessary to consider and analyze the features of the model for representing the business processes themselves.

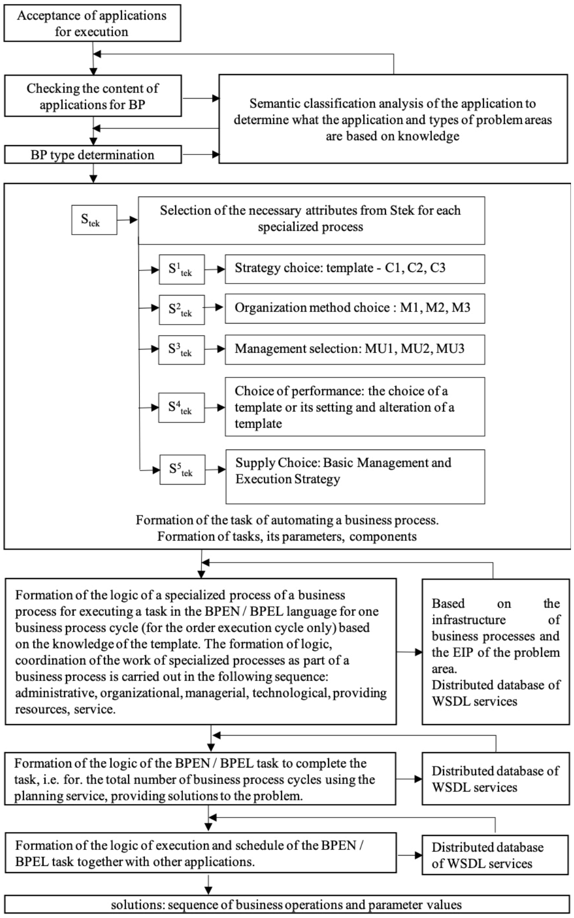

Fig. 1. Algorithm for creating systems based on platforms

3. Transfer of experience in automating business processes under variable conditions

The dynamism of the world posed new challenges for transferring experience in automating business processes to new conditions (i.e., induction), in particular [8-9]:

- under variable design conditions (goals, criteria for doing business, etc.);
- for new copies of the same problem area;
- for instances of new problem areas.

Consider ways to solve the following problem, where IP are sets of problem areas that will be called classes. IPj is a problem area with the identifier "j" or the j-th class.

Let subclasses or instances $E_j = \{E_{ih}\}$, h = 1, m_i of each problem area IP_j be given.

If the instance E_{ih} of the problem area IP_j has the automation system AS_{ih} then this instance is called the base or main instance of the problem area IP_j.

Let m_j instances $E_j = \{E_{ih}\}$, h = 1, m_i of the same class "problem area" IP_j be given. Among them, a copy of E_{ih} is core or basic, since for which the automation system AS_{ih} was created.

Task requirements: you need to create an AS_{ik} for an instance E_{ik} of the problem area IP_j. Let's look at a few cases.

Case №1

The first wording of the condition. Let $L(E_{ik})$ be the novelty level of the k-th instance of the problem region IP_j equally with the novelty level $L(E_{ih})$ of the main instance of the problem region IP_j for which AS_{ih} was created, i.e. $\Delta S = L(E_{ik}) - L(E_{ih}) \cong 0$ or $\Delta S = |L(E_{ik}) - L(E_{ih})| < \Delta 1$

The second wording of the condition. Suppose that for $LK(E_{ik})$ the level of difference between the project situations of the k-th instance of the problem area IP_j and the project situations $LK(E_{ih})$ is basically the h-th instance of the problem area IP_j for which AS_{ih} is created, conditions $LK(E_{ik}) < \Delta 1$ are satisfied.

Decision. In this case, the solution is to replicate AS_{ih} of the main instance of the problem area for the k-th instance of the problem area IP_j.

This paper does not reveal the formula for calculating the expression: $LK(E_{ih})$, $L(E_{ik})$, $LK(E_{ik})$, $LK(E_{ih})$, $\Delta S = L(E_{ik}) - L(E_{ih}) \cong 0$, $LK(E_{ik}) \cong 0$.

Case №2

The first wording of the condition. Let L(Eik) be the novelty level of the k-th instance of the problem region IPj equally with the novelty level L(Eih) of the main instance of the problem region IPj for which ASih was created, i.e. $\Delta 1 < \Delta S = L(Eik) - L(Eih) < \Delta 2$ or $\Delta 1 < \Delta S = |L(Eik) - L(Eih)| < \Delta 2$.

The second wording of the condition. Suppose that for LK(Eik) the level of difference between the project situations of the k-th instance of the problem area IPj and the project situations LK(Eih) is basically the h-th instance of the problem area IPj, for which AS_{ih} is created, the conditions $\Delta 1 < LK(E_{ik}) < \Delta 2$

Decision. In this case, the solution is to customizing AS_{ih} of the main instance of the problem area for the k-th instance of the problem area IP_j.

This paper does not reveal the formula for calculating the expression: $LK(E_{ih})$, $L(E_{ik})$, $LK(E_{ik})$, $LK(E_{ih})$, $\Delta S = L(E_{ik}) - L(E_{ih}) \cong 0$, $LK(E_{ik}) \cong 0$.

Case №3

The first wording of the condition. Let $L(E_{ik})$ be the novelty level of the k-th instance of the problem region IP_j equally with the novelty level L(Eih) of the main instance of the problem region IPj for which ASih was created, i.e. $\Delta 2 < \Delta S = L(Eik) - L(Eih) < \Delta 3$ или $\Delta 2 < \Delta S = |L(Eik) - L(Eih| < \Delta 3$.

The second wording of the condition. Suppose that for LK(Eik) the level of difference between the project situations of the k-th instance of the problem area IP_j and the project situations $LK(E_{ih})$ is basically the h-th instance of the problem area IP_j, for which AS_{ih} is created, the conditions $\Delta 2 < LK(E_{ik}) < \Delta 3$.

Decision. In this case, the solution is to create AS based on the platform, taking as AS_{ih} the main instance of the problem area for the k-th instance of the problem area IP_j

This paper does not reveal the formula for calculating the expression: $LK(E_{ih})$, $L(E_{ik})$, $LK(E_{ik})$, $LK(E_{ih})$, $\Delta S = L(E_{ik}) - L(E_{ih}) \cong 0$, $LK(E_{ik}) \cong 0$.

Case №4

Suppose there are “problem areas”: IP = {IPj}, where IP are sets of problem areas that will be called classes; IPj is the problem area with the identifier "j" or the j-th class, IPq is the problem area with the identifier "q" or the q -th class.

Let the problem region IPj have instances EJ = {Eih}, h = 1, mi and let the problem region IPq have instances Eq = {Eqf}, f = 1, mq

The Eih instance of the IPj problem area has an ASih automation system, but not one instance of the IPq problem area has an automation system.

Task requirements: it is required to create AS qf for the f-th instance $E_{qf} \in \mathbf{E}_q$ of the problem area IP_q.

Decision. In this case, the solution is to create AC_{qf} for the f-th instance of the IP_q problem area from scratch without using the AS_{ih} creation experience.

In all cases, design is carried out under the condition that the design or production environment belongs to the same class and is characterized in a general way as follows.

At time t, the production situation for the business process is determined or set in this way:

$$SP(t) = \langle Z(t), Jb(t), Sl(t), EP(t), BP(t) \rangle, \tag{1}$$

Where:

- SP (t) - production situation arising before the business process and its automation,
- Z (t) - the purpose or purpose of the business process,

• Jb (t) - task at the current time,
• Sl (t) - the subject of labor at the current time,
• EP (t) - factors and environmental objects that directly affect the implementation of the business process (means of transportation),
• BP (t) - the state of the business process, characterized by the values of the indicators of the business process.

4. **Technology for creating an automated system based on a platform for automating a business process**

The establishment of business operations in the “as-is” chart is required to be used for a pre-project survey of the methodology process and the use of the following tools [10]:
• IDEF0 - functional modeling methodology
• IDEF3 - process description methodology
• DFD - data flow modeling methodology
• IDEF1X - data modeling methodology.

If the platform is built on the upper hierarchical level, then the services should be more complete, heavy and vice versa. The result of the process description is presented in the form of diagrams as is. The declarative presentation of the diagram is a paradigm and it expresses the logic of work without a description of their management. This is the as-is chart.

Depth of detail operations, i.e. hierarchy levels can be as many as feedback loops of the multi-loop operation itself. But hierarchy is presented at three levels. At the top level, only a sequence of operations is specified. This can be done with an IDEF3 chart. At the second level, the composition of operations and the feedback loop are revealed. The third and further levels are further details of business operations. There are contradictions between the selected operations in the form of a diagram as is and the selected services. The deeper the operations stand out (diagrams as they are), the service requirements are weakened. The level of detail depends on the level of granularity of services to solve the automation task of this business process.

The given cases of applying the methods of using experience are immeasurable. Therefore, measurable methods of problematicity are given.

Case №1

Platform design since Vs (1) = 1, Vs (2) = 0, Vs (3) = 0.

Where Vs (i) = 1 if the i-th level of the as-is diagram is the same. Define diagrams of 2nd and 3rd levels. Platform design required. Vs (1) = 1, Vs (2) = 0, Vs (3) = 0. Where Vs (i) = 1 if the i-th level of the as-is diagram matches the diagram of the current subject space. In this case, the designation means that Vs (1) = 1 - the diagram of the 1st level coincides, the diagrams of the 2nd and 3rd levels do not coincide.

The built platform at this level will be universal, but less effective. At this level, BPEL is more granular (you can enable services in the form of systems and integrate them. For example, a reporting platform), so you need to increase the service. Make them flexible.

Case №2

Customization Vs (1) = 1, Vs (2) = 1, Vs (3) = 0. Customization of specialized processes: organization, management.

Customization is required since Vs (1) = 1, Vs (2) = 1, Vs (3) = 0. It is necessary to configure specialized processes: organization, management.

The built platform at this level will be less universal, but more effective.

Case №3

Replication Vs (1) = 1, Vs (2) = 1, Vs (3) = 1. Service tincture

Replication required since Vs (1) = 1, Vs (2) = 1, Vs (3) = 1. Need tincture of services.

Case №4

Decomposition of each business transaction, taking into account or following (in contrast to IDEF0) the sequence of their execution. This is achieved by the fact that it is not the first level that defines the relationship, but at the subsequent stage each business operation is individually decomposed.

Each business transaction is identified by coordinates (X, Y, Z, F,), where X is the ordinate axis, Y is the abscissa axis, Z is the level number, F is the depth number.

If the as-is process diagram simply corresponds to a process or technological process consisting of technological operations, then the to-be diagram corresponds to a business process.

Thus, the design of the diagram as it should be “to-be” corresponds to the formation of a business process and, accordingly, the design of an automation system for a given business process.

Imperative presentation of diagrams is a paradigm that uses statements that change the state of the world. This is the to-be diagram.

Then the programming of the diagram as it should be “to-be” corresponds to the construction of software for a business process automation system.

The process of constructing a diagram in the form in which it should be based on the models of business processes that have been proposed.

These models are as follows [11-12]:

1. The basic hierarchical model of the business process (see Fig. 2).
2. The logical model of the business process options
3. A model for ensuring observability and controllability

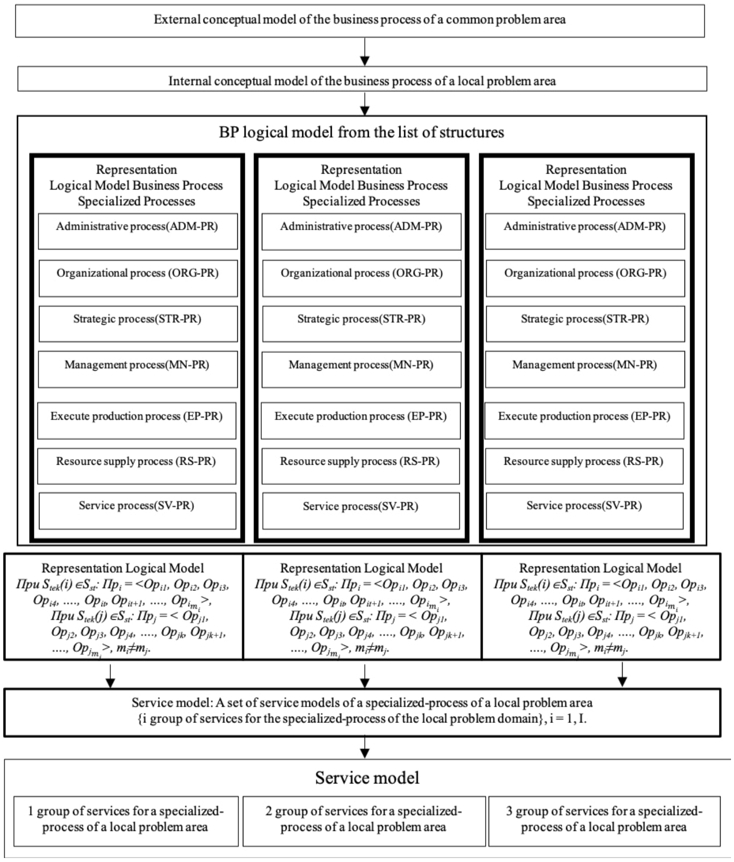

Fig.2. Extended hierarchical structure (architecture) of the main (multidimensional, semantic, nonlinear) model of the business process, taking into account the logical model of BP

The external conceptual model of the business process of a common problem area serves as a data / information transfer tool for processing procedures, sets or displays the characteristics of a business process for integration with external business processes and business process relationships, which displays the goals of a given supersystem at a macro level, information about your business process of a common problem area as an element of a single information space.

The internal conceptual model of the business process of the local problem area sets the information about the list of specialized processes included in the created business process of the local problem area, as well as the metamodel (description) of the integration of specialized processes within the business process for specific purposes within the problem area.

The model is designed to automate business processes. Therefore, we will build the model for classes of business processes that are observable and manageable. This is achieved by introducing, first of all, the strategic process, which is the beginning of the management process. Therefore, for the managerial level, the specialized process, we introduce the strategic process from which we must begin.

The logical model of a specialized process determines when and in what sequence processes are applied and executed. All these methods are the process of organization and management. The purpose of the logical model is to determine the sequence of business operations of each special process. Each business transaction consists of two parts: the operator and the procedure. Therefore, the logical model contains two levels.

At the upper level, a specialized process is presented from a stack of specialized processes of a business process of a local problem area (for example, technological or organizational, or providing process resources) of one and the same special process and these operators follow them from operations. The choice is made based on the current situation (i.e., given the initial situation, the problem area).

At the lower level, carries out a selection of procedures.

The service model for managing an operator of a specialized process of a business process of a local problem area has two types of groups:

- executive services;
- managing service.

The content of executive services depends on business operations.

The set of services of one group of the specialized process of the local problem area has different signs of objects and means of labor, as well as signs of the working environment, i.e. single information space (EIP). All this constitutes an ontological model.

The relationship is determined by the semantics of operations, i.e. first, the strategy determines the order of the main operator or process (or the main operators or processes), and then the sequence of operations and the connectedness of the operations of different specialized processes.

The structure and architecture of the model, depending on the problem being solved, can be variable.

According to the conceptual level: firstly, a different number of specialized processes, and secondly, at the logical level, a different composition of operations, i.e. may have a different content for each of them, depending on the need for the solution of which the business process is intended. As well as a different composition of internal processes.

Thus, this general model of a business process is a configuration or a combination of separate local models.

5. **Conclusions and future work**

The present paper proposed an algorithm for constructing an automated system based on platforms that considers two approaches to building an automated system:

The first approach is to build the platform to create a system based on the common properties of all instances of the problem area. Therefore, the development of the platform is based on common properties or parameters for all instances of the problem area.

The second approach to building the platform comes down to building a complete system, which is based on a system adapted to alteration, as well as on a set of services reflecting the individual characteristics of individual instances of the problem area.

In order to realize the platform in the future, it is essential to ensure the information progression between the different lifecycle stages between the different collaborators. Moreover, it is fundamental to clarify questions of information security and the authorized of data before it is possible to operate such a platform.

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