METHODOLOGY AND RECOMMENDATIONS FOR CRISIS PROCESSES

An Effective Way How to Manage Business Process Deployment in the Crisis Management

Tomáš Ludík, Jaroslav Ráček and Lucie Pekárková
Faculty of Informatics, Masaryk University, Botanická 68a, Brno, Czech Republic

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Abstract: The paper focuses on identification and software support processes in the field of crisis management. The paper aims to describe a process methodology for crisis management. The methodology consists of five main phases, being Identifying, Modelling, Configuration, Execution/Monitoring and Optimization of processes. Each phase is described in terms of individual activities, input and output artefacts, and user roles. The next part of the paper recommends the use of particular technologies, tools and resources that have been successfully proved in the analysis of crisis situations in the Czech Republic. Established process methodology and practical recommendations create the foundation for the full methodology deployment in practice. Throughout this paper the emphasis is on practical demonstration of results on a case study that applies a process methodology and hereof related recommendations in the crisis situation.

1 INTRODUCTION

The crisis management requires considerable effort. To manage crisis situations, it is necessary to spend human resources and technical resources. It is useful if there are available some best practices in solving the crisis and also specified responsibilities for particular activities. To capture such information it is appropriate to use the process management, which has been approved in the private and public sector (Kubíček et al., 2010).

Identification and subsequent automation of the process is a challenging issue. At present, there are primarily two different approaches to the business process deployment. One is based on the business process life-cycle, the second one on the overall architecture which supports the business process deployment. It is convenient to integrate the mentioned approaches to the process management for effective process deployment and create an unified view of the process deployment. Such a view is defined by Process Framework for Crisis Management (Ludík and Ráček, 2011).

The Process Framework for Crisis Management provides a basic view of the process deployment from the methodology and architecture point of view. For this reason, this paper aims to describe the process-oriented methodology, which is an essential part of the framework. The paper also contains a case study that illustrates the use of process-oriented methodology in practise and its adequate support by Business Process Management Suite.

There are many methodologies that lead the user through the process deployment, e.g. *Object Process Methodology*, *Rational Unified Process* or *Business Driven Development*. The business process analysis is the principle of these methodologies, but the process automation does not follow the process management ideology.

1.1 Object Process Methodology

Object Process Methodology (OPM) (Dori, 2000) is an approach to design information system by representing it by *object models* and *process models*. OPM combines a minimal set of building blocks with a dual graphic-textual representation in a single diagram type.

The disadvantage is the non-standard diagram notation, which has similar properties to the Data

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Flow Diagram. Another disadvantage is a low correlation between modelled process diagrams and their subsequent implementation.

1.2 Rational Unified Process

The Rational Unified Process (RUP) (Shuja and Krebs, 2008) is an iterative software development process framework created by IBM in 2003. RUP is not a single concrete prescriptive process, but rather an adaptable process framework, intended to be tailored by the development organizations and software project teams that will select the process elements that are appropriate for their needs.

The disadvantage of RUP methodology is that business process analysis is used only at the beginning in order to create business requirements. The final application reflects the business processes, but there is not created a closer bond with them. Therefore, even a small change of business process leads to a fundamental change of the created information system.

1.3 Business Driven Development

Services-Oriented Architecture (SOA) provides an IT framework along with a set of principles and guidelines to create IT solutions as a set of reusable, and configurable services that are independent of applications and runtime platforms. Transitioning an enterprise to SOA requires a Business Driven Development (BDD) approach that uses business goals and requirements to drive downstream design, development, and testing (Mitra, 2005).

It is the best of so far described methodologies from the view of the close interdependence to business processes. But there is missing the application of a workflow reference model that allows to deploy the modelled process instance directly to the workflow engine.

2 PROCESS ORIENTED METHODOLOGY

The created process-oriented methodology is based on the above mentioned methodologies but also eliminates their disadvantages. This innovative methodology is described in terms of different phases, from which it is composed, as well as in terms of user roles and work products generated by this methodology.

2.1 Phases

The first phase of the methodology is *Identifying* (Figure 1). In this phase the strategic objectives of the organization are defined. In accordance with them there are also identified processes that bring added value to the organization. These processes can be divided into *primary*, *support* and *management* processes (Fiala and Ministr, 2007). It is also appropriate to assign responsibility for individual processes and particular activities as well. It is appropriate to use the Use Case Diagram to integrate processes and user roles. The output of the phase is a list of business requirements. It is convenient to define the Glossary to better understand the area of interest, which facilitates communication between user roles. The last tasks of the phase are verification and validation of business requirements.

In the *Modelling phase*, the business process is modelled in detail and decomposed into several levels, depending on its complexity (Weske, 2007). During this phase the emphasis is on the correct data flow in processes. Decision-making in processes is solved by using business rules, which could be changed during the process runtime. Designed processes should be simulated in this phase. Simulation can reveal bottlenecks in the process and also visualize the process functions. The outcome of this phase is the system requirements determination. System requirements should be verified and approved by the user-validation. Key outcome is the appropriate automation level determination.

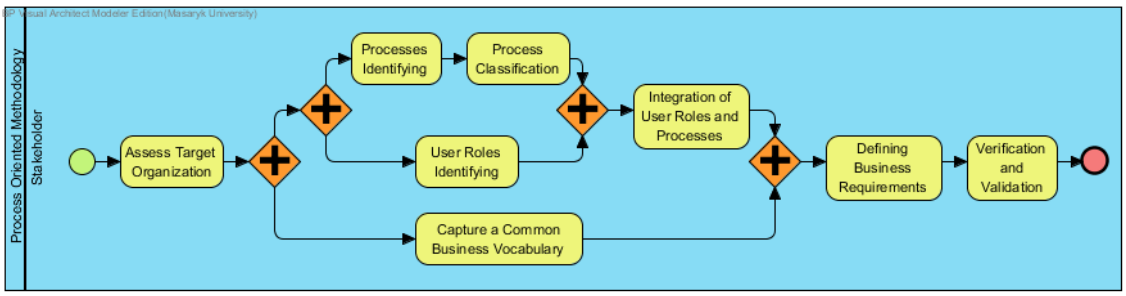

Figure 1: Identifying phase of Process Oriented Methodology.

The Configuration phase deals with detailed set up of business processes. Processes are transformed into the configuration phase mostly in Business Process Execution Language (BPEL). In this form they are accompanied by the necessary functionality build on service-oriented architecture. Processes consist of already existing services or of the brand new ones that need to be programmed. In this phase are created the key performance indicators (KPI) that are intended for the process performance control during the runtime. In such way the comprehensive application is built on business process. Its instances can be deployed on the workflow engine. The created system is set to the end customer. The service and process testing, as well as system validation, belong to the control mechanisms.

The Execution/Monitoring phase provides primarily two activities. First it is an administration of running process instances in the workflow engine, which allows the end users to work with the processes. Created applications can be set up and configured during the runtime. Business rules enable the configuration of the branching in processes, which enables better response to possible changes in a company. Setting of the user rights and roles is another option. Roles and rights can be assigned or removed for the current or new users, according to their current responsibilities. This phase is also responsible for process monitoring and for gathering data about the process run. Based on this information, it is possible to evaluate the process progress and partly adapt the process on the flow. Defined KPIs have a great impact. They enable overall control of the process and therefore also a rapid response to sudden changes.

The last phase is *Optimization*. This phase is crucial for continuous process improvement. During the monitoring phase the data about process instances are collected, which may result in some gaps in the modelled process. There are some advanced techniques of mathematical statistics or process mining available for the process instances analysis. Based on the results it is possible to choose two different approaches to process improvement. It is a Business Process Reengineering (BPR) or a Total Quality Management (TQM) (Řepa, 2007). TQM is focused on the consequent improvement of processes, BPR focuses on radical changes.

2.2 Roles

Stakeholder represents interest groups whose needs must be satisfied by the project. It is a role that may be played by anyone who is (or potentially will be) materially affected by the project outcome.

Business analyst is a high-level role responsible for the business analysis and BPM work activities. The business analyst performs process modelling and creates functional specifications for process.

Architect is a high-level role responsible for the overall work effort of creating the architecture and system design. More specialized roles, such as enterprise architect, application architect, SOA architect, and infrastructure architect, are actually responsible for various architectural work efforts that constitute the design phase of the project.

Developer is a high-level role responsible for the implementation of the result (services).

Tester is a role responsible for performing activities required to test the application before it is deployed into a production environment.

Line Manager is a person who heads revenue generating departments (manufacturing and selling) and is responsible for achieving the organization's main objectives by executing functions such as policy making, target setting or decision making.

2.3 Work Products

This section describes the outputs generated by the methodology. Thus outputs are quite a bit through the methodology phases and therefore only main outcomes of the various phases are described.

Business Requirements are based on customer's wishes and their needs. They describe the principles and functioning of a company as a whole, defining its objectives (Shuja and Krebs, 2008). Identified processes are part of these requirements.

System Requirements are the modelling phase results. These are the requirements for creating an information system built on business processes. Detailed and hierarchically organized process diagrams are part of this output. These requirements also describe the level of process automation.

Information System is a result of the configuration phase. Modelled processes are configured and composed of individual services. Thus created processes are deployed on a process engine, which interprets them. The workflow engine also allows interaction with users and external tools.

Monitoring data is an output of the monitoring phase. It contains information about process instances run, such as duration or cost of individual processes. It also records the passing through the business process, which can be useful in further analysis.

Strategic plans are the optimization phase outputs. The overall technology improvement (TQM, BPR) and strategic plans for further business process improvement are chosen in strategic plans.

3 RECOMMENDATIONS FOR CRISIS MANAGEMENT

In case the methodology is used in the field of crisis management it is appropriate to consider certain features that arise from this specific area. This features are illustrated on crisis management in the Czech Republic.

3.1 Organizational Structure

The Integrated Rescue System (IRS) is determined for co-ordination of rescue and clean-up operations in case, where a situation requires operation of forces and means of several bodies, e.g. fire fighters, police, medical rescue service and other bodies, or in case, where the rescue and clean-up operation is necessary to be co-ordinated from the Ministry of Interior or by a leader of region's level, or by mayors of municipalities with extended responsibilities (Rektořík, 2004). As the Integrated Rescue System are therefore considered the co-ordinated proceedings of its bodies during preparations for crisis situations, and during rescue and clean-up operations.

3.2 Legislation and Documentation

There are many laws dealing with crisis management in the Czech Republic. Crisis management elements are codified in the Law No. 240/2000 on crisis management and on modification of certain codes (Crisis Code), in latter wording. The other important Law is the Law No. 239/2000 on the Integrated Rescue System and on amendment of certain codes, in latter wording. It is the basic legal frame describing situation around IRS.

Another feature of the crisis management is the detailed documentation that defines how to proceed in particular situations. The Contingency Plans belong to the basic documents. They contain a set of measures and procedures addressed to crisis situations.

3.3 Different Types of Information

To successfully deal with critical situations, it is inevitable to have all the necessary information at disposal. It is often not trivial because the information used in crisis management can have three basic characteristics or dimensions: *time*, *space* and *aggregation*. The time dimension of the data is important in the crisis situation with dynamic character. This information varies with time so it is a relevant factor in dealing with the crisis situation. Another important aspect of the information is that it is bound to the intervention place. It is only the limited area around the intervention place that is important and it can be defined according to the character of the crisis. The last dimension of the information relevant to dealing with a crisis situation is aggregation. The data is provided in aggregated form, for example as specific maps or map layers. However, they contain also specific data sets that could be irrelevant to the character of a particular intervention location or to the crisis itself. The way to avoid unnecessary information is to use adaptive mapping (Kubíček et al., 2010).

3.4 Psychological Aspects

There is a new belief that even despite the devastating impact of disasters, substantial lack of resources, and general chaos, there is still a possibility of carrying out some actions that will serve in maintaining at least the basic integrity of the human society and its dignity. Psychological aspects are usually very important for dealing with crises. All activities of crisis management are performed under substantial time and psychological pressure. Intervention commanders work and make decisions in fear of their possible failure. They often have insufficient and inaccurate information. Other problems arise from lack of necessary resources. The basic requirements of life may sometimes be restricted under the influence of all these factors.

3.5 Using of Standards

Unified Modelling Language (UML) is a standardized modelling language used in the field of software engineering. Two diagrams are especially suitable for process modelling: *Use Case Diagram* and *Activity Diagram*.

Business Process Modelling Notation (BPMN) (Silver, 2009) provides a notation that is readily understandable by all business users. This way, BPMN creates a standardized bridge over the gap between the business process design and process implementation.

Web Services Business Process Execution Language (WS-BPEL) defines a model and a grammar for describing the behaviour of a business process based on interactions between the process and its partners (Jordan and Evdemon, 2007). WS-BPEL introduces a mechanism to define how individual or composite activities within a unit of work are to be compensated in cases where exceptions occur or a partner requests reversal.

4 CASE STUDY

To demonstrate the practical use of the process-oriented methodology in crisis management a typical activity STC - 05/IZS called “Finding an object that is suspicious to contain B-agents and toxins” is chosen. Typical activities describe cooperation of the Integrated Rescue System (IRS) components for joint intervention (Kubíček et al., 2010). This group of documents is released by the Directorate of Fire Brigade of the Czech Republic.

4.1 Application of Methodology

At *Identifying phase* it is important to understand the research problems and identify the individual processes. The main output is a good theoretical preparation for the next phase of the methodology. Intervention from the perspective of the Intervention commander begins when the commander arrives into the site of finding a subject that is suspicious of the presence of B-agents or toxins. The Intervention commander immediately conducts an *evaluation of the situation*. In case of a threat the intervention commander decides about organization of the intervention and future joint actions. *Coordination with emergency medical service* (EMS) provides medical assistance to affected civilians and rescue teams. In parallel with this activity intervention units carry out in the affected area *disinfection and medical examination of people* and *decontamination of the area*, especially suspicious object and location findings. When all of these activities are finished, the intervention commander *ends the intervention*. At the moment ends a common intervention of IRS components.

Consecutively, there is the *Modelling phase*. Based on the previous proposal the process model is created (Figure 2). The diagram shows the order in which activities are behind, what data streams flow between them and what the outcomes of the process are. The process is modelled in BPMN notation. This phase also includes a simulation and process optimization possibility. Simulation can show the bottlenecks as well as lead the user through the individual process steps to check whether the process is modelled in accordance with the user’s wishes. This phase results in verified, validated and simulated processes (Mak et al., 1999).

To *Configuration* the process model means that processes first need to be supplemented by specific data types, especially in the simplified form. These forms wander through processes and every activity adds new information to them. This phase of the process-oriented methodology also involves making key performance indicators and the monitoring model, which will monitor and evaluate the deployed process. In order to implement instances of automated processes, it is necessary to convert the processes into a format that is computing processable. For this purpose Business Process Executive Language (BPEL) is used. The created process is then deployed into a process server.

The *Execution/Monitoring phase* is essential to execute and monitor processes and to visualize conditions of the process instances. The monitoring process is an important mechanism to provide accurate and timely information on conditions of process instances. Important modules are primarily *Sequence diagram of human work, Detailed activity description* and *Key performance indicators*.

The last phase is the *Optimization*. The basics for this phase are data from processes monitoring that are used to evaluate and optimize business process models and their implementations. Execution logs are evaluated by using business activity monitoring and process mining techniques. These techniques aim to identify the quality of business process models and adequacy of the execution environment.

For instance, business activity monitoring might reveal that a certain activity takes too long due to shortage of resources required to conduct it.

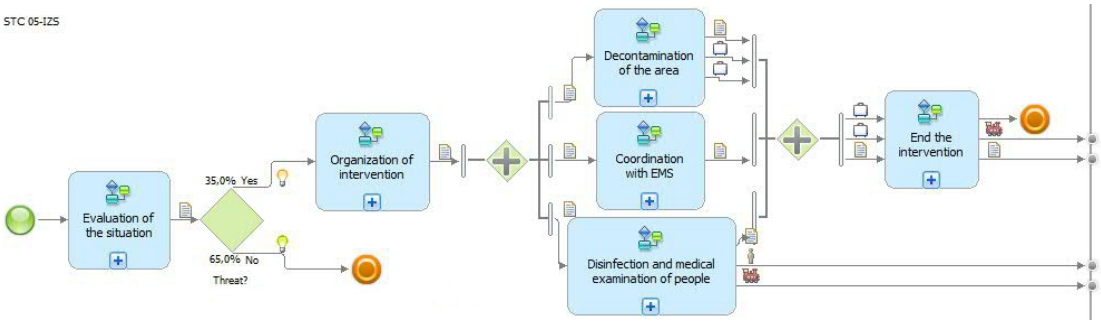

Figure 2: Process model of typical activity STČ – 05/IZS.

4.2 Business Process Management Suite

The overall architecture is often composed of a set of tools covering everything necessary to deploy complex processes in the organization. Such a software package is called *Business Process Management Suite* (BPMS). Unlike the first generation instrument, which was conceived as a compilation of several separate programs, by far did not cover the requirements of the complex architecture necessary for the deployment of processes. Current systems already offer comprehensive and holistic options tools with an intuitive user interface, which covers complex architecture requirements.

For this case study IBM WebSphere software was used. The software includes programs that cover the elements of architecture describing the process framework for crisis management (Ludík and Ráček, 2011). There are many other solutions, of course.

5 CONCLUSIONS

The primary contribution of this paper is the innovative, process-oriented methodology. The methodology is described in terms of phases, user roles and work products. The paper also describes set of recommendations, which should be applied when methodology is used on crisis management processes. These are based on practical experiences when solving the research plan called *Dynamic Geovisualisation in Crises Management* (Kubíček et al., 2010; Ludík and Ráček, 2011). The paper also illustrates the practical use of the methodology in real situation called "Finding an object that is suspicious to contain B-agents and toxins".

It is appropriate to emphasis on adequate software support during the use of methodology. This support is provided by *Business Process Management Suite* (BPMS), where different tools support different methodology phases. In case of a comprehensive crisis management system it is necessary to take the close interoperability to GIS or other systems used by the IRS into account. Therefore it is recommended to add the global architecture which will illustrate the overall deployment of the system based on processes.

The subsequent objective of this research is to define in detail the methodology phases in terms of individual tasks and their links to each other. This is related to the assignment of responsibilities for these tasks. Similarly, detailed description of the role associated with implementing the methodology in terms of ICT and crisis management is needed. The final aim is to describe the task inputs and outputs in detail in terms of work products and determine whether all information is available at the right time.

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