

Computational Assistance of the Research, Using Dynamic Vector Logistics of Processes for Critical Infrastructure Subjects Continuity

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Abstract—This paper deals with using of prevailing operation system MS Office (SmartArt...) for mathematical models, using DYVELOP (Dynamic Vector Logistics of Processes) method. It serves for crisis situations investigation and modelling within the organizations of critical infrastructure. In first part of paper, it will be introduced entities, operators, and actors of DYVELOP method. It uses just three operators of Boolean algebra and four types of the entities: the Environments, the Process Systems, the Cases, and the Controlling. The Process Systems (PrS) have five “brothers”: Management PrS, Transformation PrS, Logistic PrS, Event PrS and Operation PrS. The Cases have three “sisters”: Process Cell Case, Use Case, and Activity Case. They all need for the controlling of their functions special Ctrl actors, except ENV – it can do without Ctrl. Model’s maps are named the Blazons and they are able mathematically - graphically express the relationships among entities, actors and processes. In second part of this paper, the rich blazons of DYVELOP method will be used for the discovering and modelling of the cycling cases and their phases. The blazons need live PowerPoint presentation for better comprehension of this paper mission. The crisis management of energetic crisis infrastructure organization is obliged to use the cycles for successful coping of crisis situations. Several times cycling of these cases is necessary condition for the encompassment for both emergency events and the mitigation of organization’s damages. Uninterrupted and continuous cycling process brings for crisis management fruitfulness and it is good indicator and controlling actor of organizational continuity and its sustainable development advanced possibilities. The research reliable rules are derived for the safety and reliable continuity of energetic critical infrastructure organization in the crisis situation.

Keywords—Blazons, computational assistance, DYVELOP method, critical infrastructure.

I. INTRODUCTION

THIS paper serves for usefully introduction of DYVELOP mathematical – graphical method [8] and its using for computer assistance in application for the modelling and application of critical situations in the environments of Czech energetic critical infrastructure. Basic terminology of DYVELOP method follows [9].

- **Entity** is it what exists, or what is possible to imagine even in human mind on any scene.
- **Dominance** is predominant aspect on the scene
- **Domains** are *real time, space and environments*, dominating entities independent on a controlling of

human perception. **Controlling** (ctrl) is generalized capability – to have control over situational policy.

- **Controlling actor** is an executor of ctrl functions.
- **Environment** (ENV) is entity’s 1st kind, having principal domain role of any scene *without defined* ctrl actor.
- **Process System** (PrS) is entity’s 2nd kind, having transformation role of inputting to outputting things and its *external* ctrl actor operates from its defined ENV.
- **Case** is entity’s 3rd kind, having complex situational set role of process’s entities, requiring the purpose or action fruition in certain circumstances and conditions, according its *inherent* ctrl actor, initiating and composing case situation.
- **Operation** represents the process chains / nets, running in dominant real time & environments, needing a work of real process factors (agents, actors, participants...).
- **Scenario** is formal record of the operations on scene & arena environments, having a **Libretto** as one-sentence summary.
- **Scene** is exact specified framework of scenario entities.
- **Arena** is space specified framework of scenario entities.
- **Scenery** represents instant perception of the scene and arena.
- **Event** is the PrS’s manifestation and realization on operational scene, as well as situational symptom or occurrence.
- **Circumstance** affects and guides event’s process.
- **Map** [5] is survey arrangement of entity’s portfolio.
- **Blazon** [8] is scenic meta-model, representing the entities’ roles, semantics and their *relationships* in pictographic maps.
- **Interface** [9] is relative domain, symbolising, defining and demarcating *typological* differences among entities.
- **Critical interface** encloses antagonistic negate entities.
- **Crisis interface** encloses more than two antagonistic entities.
- **Situation** is qualitative and quantitative manifestation of event scenery, influenced by the environments and circumstances. **Crisis situation** has over than two critical/ crisis interfaces and it is succeeded to the emergency state. **Crisis measure** designates organizational and technical solution of crisis situation and the elimination/ mitigation of its consequences.
- **Extraordinary event** initiate crisis situation origin.

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II. DYVELOP: TYPOLOGY, SYMBOLS, AND ROLES [8]

A. Mathematical - Graphical Relations of the Entities

Mathematical - graphic relations of DYVELOP entities might express *semantic relations*, using Boolean algebra operators AND, OR, NOT - see Fig. 1.

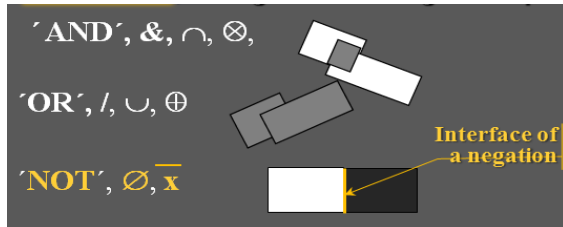


Fig. 1 Semantic relations



Fig. 2 Structural relations

For *structural relations* expression are used common symbols of system flowcharts (see Fig. 2) and algorithms.

B. Environments

The definition for the environment (ENV) was mentioned at the beginning. In this moment is necessary to accent that the ENV has mathematical role of *principal domain* of any scene *without defined ctrl actor* [3].

Symbol for the ENV on two-dimensional scene is blazonry expressed at Fig. 3. Here, it must be typologically demarcated double dash curve / line.



Fig. 3 Symbol for the environment

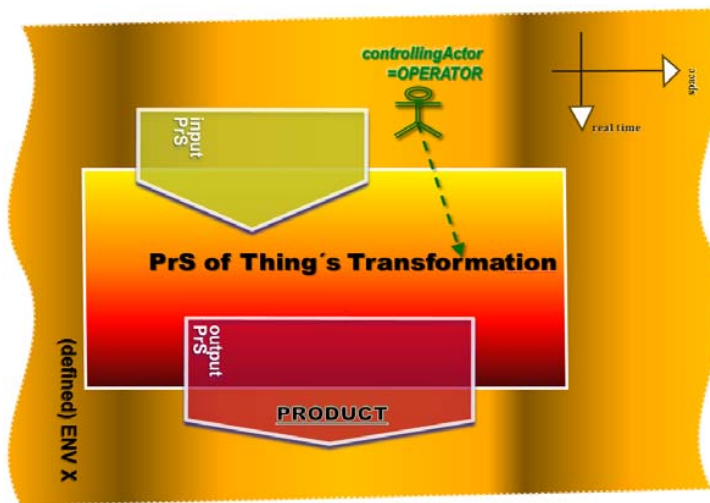


Fig. 4 Process system for things transformation and production

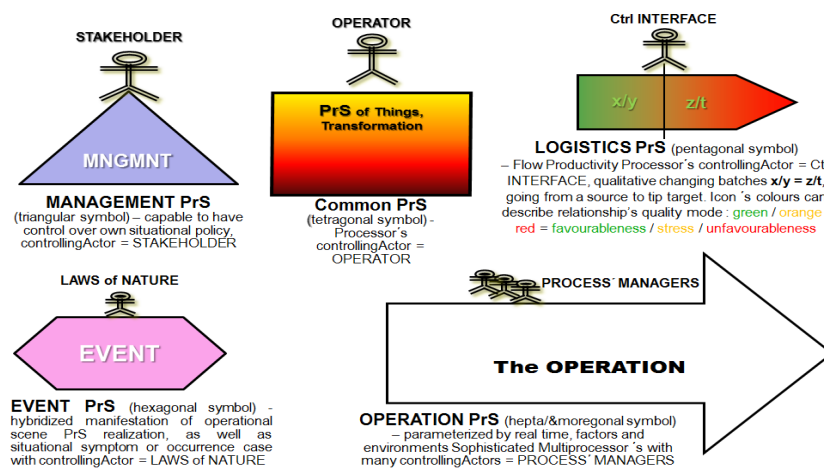


Fig. 5 The typology of "five PrS" brothers

C. Process Systems

The definition for the process system (PrS) was mentioned in the first part of the article. Here is necessary to accent that the PrS has mathematical role of transformation of inputting things to outputting new-things. The both in/out-puts symbols as the typical processes are displayed blazonry by five-corner arrows as logistic process systems (see Fig. 4). The aim of outputting logistic PrS is a *Product*. PrS's defined ENV X is parameterized by the domains 'space' and 'real time'. Last named real time is going by the page top to the bottom on the blazon, similar as on any algorithm. At Fig. 4 is the most common PrS: the 'PrS of Thing's Transformation', which symbol must be typologically demarcated by single lines with four sharp corners. It has its *external* ctrl actor – the OPERATOR, which operates from its defined ENV X – quod vide blazonry at Figs. 4 and 5 [1], [2].

On Fig. 5 is blazonry expressed that the process systems have typologically just a five "PrS' brothers": Management PrS, Transformation PrS, Logistic PrS, Event PrS and

Operation PrS. They all are sufficient for expression and DYVELOP modelling of all possible type and characteristics of arbitrary process systems. They all need for the controlling of their functions special ctrl actors (defined on blazon), functioning *externally* from pertinent PrS's environments. The externality is their special characteristic [4].

D. Cases

Compare with the process system, the Cases significant characteristic is that its controlling actor is *inherent* entity. They have more complex system of processes and functions. The best view to its complexity brings the smallest, but quite autonomous PrS: the *Process Cell Case* [9]. Its blazonry symbol has the shape of a "puzzle" at Fig. 6. Process cell has processor's operational behavior, but its characteristics are more complicated complex and hybrid, making automatic functions as the smallest autonomous automat case on defined ENV XY.

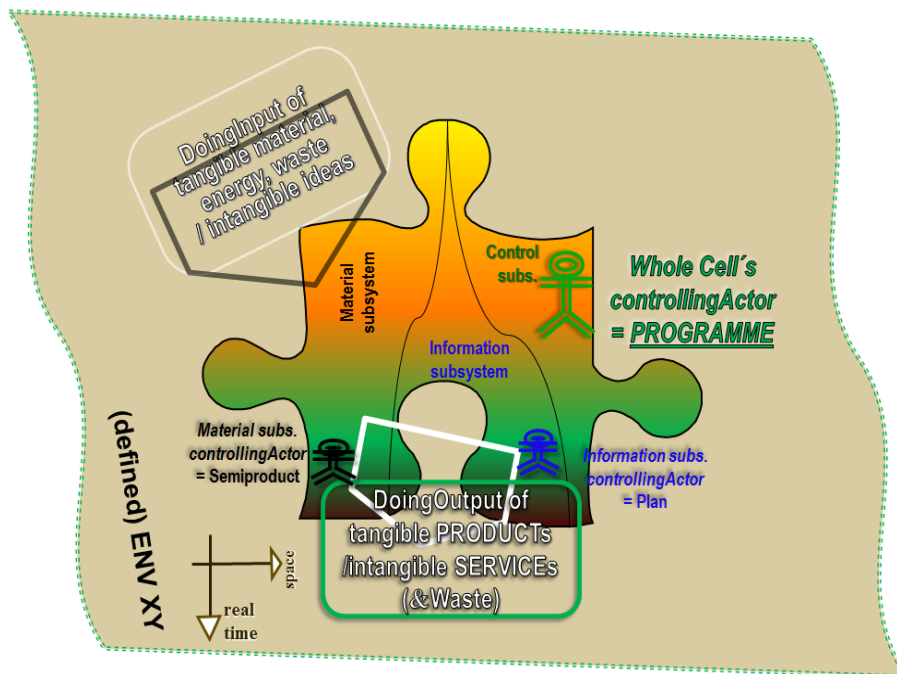


Fig. 6 The Process Cell

Whole cell's ctrl actor is a PROGRAMME, which is inherent part of process cell "body", functioning in cell control subsystem. The programme has complex controlling, control and regulation roles also. However, the cell as the automat needs two furthers subsystems: material and information. Here the role of ctrl actor takes a semi-product in material subsystem and plan in information subsystem. On Fig. 6 is defined tangible or intangible cell's input. The objective and output of process cell operation is tangible products and intangible services. However, here is unrequired co-product - a waste always.

On Fig. 7 is blazonry expressed that the cases have typologically just a three "Case's sisters": Process Cell Case, Use Case and Activity Case. First sister the Process Cell Case was introduced on previous picture and its symbol is by simply way repeated at Fig. 7. Second sister is the *Use Case* (corner rounded polygonal symbol). It has inscribed alphanumeric legend, which is *cursive typified gerundive form* as *verbal noun* ending in '-ing', which has a function of a noun and at the same time shows certain verbal features [7]. It can be 'cameLetter' completed by process specification, expressing structural things always. Case's complex

situational set create a lot of the process' entities, process cells (organized to the 'funnels'), circumstances, conditions, various environments [3] and much of single processors (representing by puzzle symbols of the cells). Here, an output

from the one entity often directly forms an input into another process entity, requiring the purpose fruition according to its inherent controlling actor – the USER; from of whose perspective the Use Case is initiated and composed.

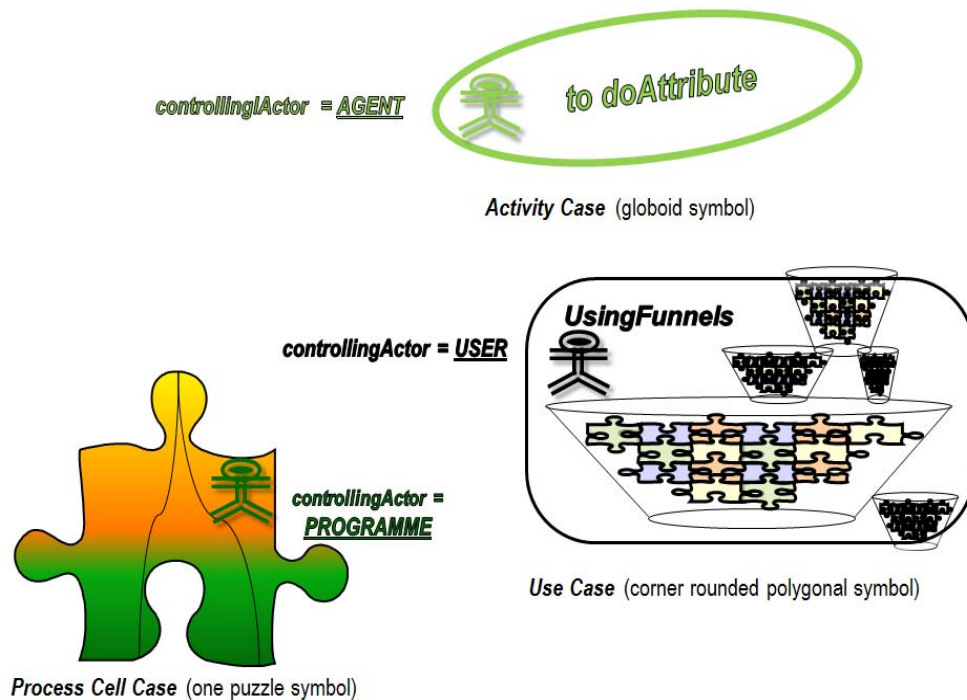


Fig. 7 The typology of "Three Case's sisters"

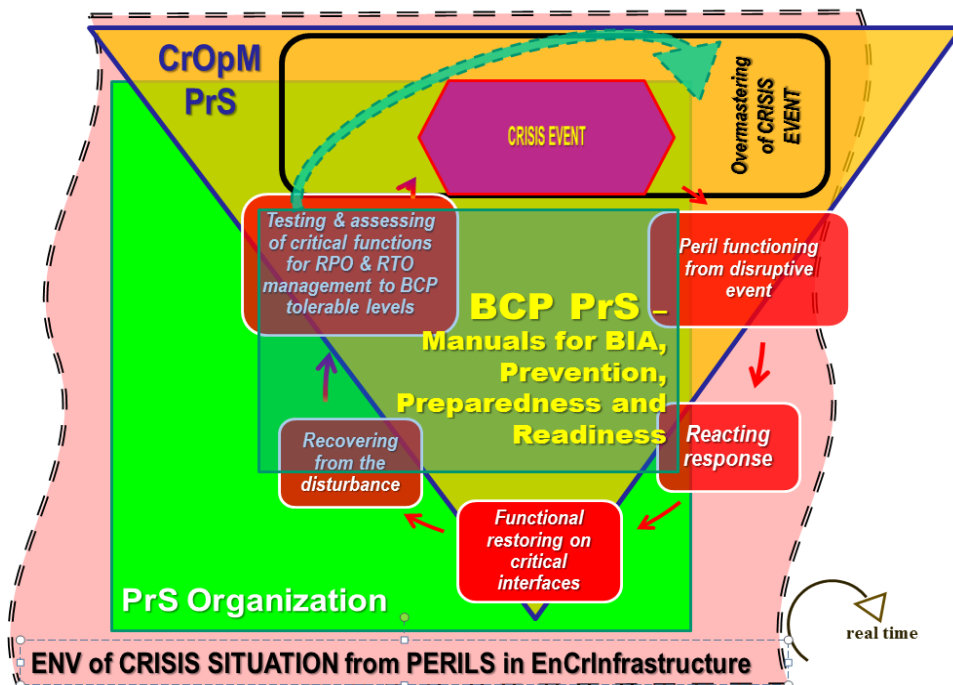


Fig. 8 The blazon of crisis situation

Third sister is the **Activity Case** (globoid symbol). It has inscribed legend, which is *curative typified process verb* mostly as an infinitive with 'to' preposition [2]. It can be 'camel Letter' completed by the attribute. It represents single operational process' function, aiming & specifying terminal, or transit change of the thing, state, structure, behavior, interaction, capability, service, relation, situation, or attribute within real operation. Activity Case requires action fruition under its *inherent* controlling actor – the AGENT [1].

III. DYVELOP FOR SPECIAL MODELLING [9]

In this chapter of this paper, the blazons of DYVELOP method will be used for the discovering and modelling of the cycling cases and their phases. Each blazon's better comprehensions need live PowerPoint presentation for better displaying of this paper mission. The crisis management of energetic crisis infrastructure (EnCrInfrastructure) is obliged to use cases cycles displayed on Fig. 8 for successful coping of crisis situations. The cycle [7] is native controlling actor for any course almost of all natural or healthy man-made processes. Any uninterrupted cycling of the processes is good indicator of sustainable development [6]. General question asserts to the foreground of EnCrInfrastructure organization system's vulnerability and security during not only economic, but even any process of 'life cycles': *How the resilience and resistance are of organizational 'processes life cycle' against relevant threats, perils and hazards?* [9]. The answer can be obtained from the analytic, planning, testing and auditing procedures, according of international (British) BS 25999-2 and global ISO family 22300 standards - for a Business Continuity Management System – BCMS [9].

In crisis situation of EnCrInfrastructure, not all playing entities are only in cooperative relations on real societal security scene. However, always there have been numerous participating 'enemies', which play apparent or hidden opponent roles with prosperous organization system. They can overgrow till in antagonistic dramatically irreconcilable relations, resulting to crisis scene or even to battle theatre. But for a purpose of this paper, the main behavior of modelled entities of EnCrInfrastructure will be trended to continuity obtaining in cyclic organizational processes.

Dynamical blazon with real time, cycling clockwise on the Fig. 8, displays the EnCrInfrastructure's crisis operation. Here, Crisis / emergency specialized operation system named <<CrOpM PrS>> (triangular symbol) acts as a part of organizational <<PrS Organization>> of EnCrInfrastructure total management system. It sets and innovates of the continuity cyclic process approach of total integrated management system activities and processes in whole organization's life cycles. The Business Continuity Planning PrS <<the BCP PrS>>, producing 'Manuals for BIA, Prevention, Preparedness and Readiness', serves for organization's business continuity management successful processes and for the system the crisis management operation <<CrOpM PrS>>, using Business Impact Analysis (BIA) and others evaluative tools. They use for the prevention, preparedness & readiness processes. In blazoning

scenario at Fig. 8, all PrSs work systematically and permanent for EnCrInfrastructure organizational processes continuity and efficiency improvement, operating at organizational threat's environment <<ENV of CRISIS SITUATION from PERILS in EnCrInfrastructure>>. They provide threats prediction, prevention, preparedness and readiness, as well as the risk analysis and scenario design for continuity solution and testing of organizational acceptance and maintenance services for the <<PrS Organization>>. These services are implemented only, if an <<EMERGENCY EVENT>> (hexagonal symbol) enforces an intervention. It is clear that this <<CrOpM PrS>> intervention and response procedure is initiating only after ad hoc <<EMERGENCY EVENT>> occurrence, which activates 'critical functions'. Then it immediately acts and operates of the use cases in the cycle at Fig. 8: <<Peril, functioning from disruptive event ⇒ Reacting response ⇒ Functional restoring on critical interfaces ⇒ Recovering from the disturbance ⇒ Testing & assessing of critical functions for RPO & RTO management to BCP tolerable levels>>. These use cases cycle is multiple repeating for the RPO & RTO successful obtaining. It brings <<EMERGENCY EVENT>> elimination and consequently it is issuing to terminal asked the <<Overmastering of CRISIS EVENT>>. These mastering guarantees satisfy organization continuity, improving the processes of <<The BCP PrS>>. From the RPO (Recovery Point Objective) is used, identifying maximum tolerable functions loss for each activity, which cannot be exceeded. The RTO (Recovery Time Objective) is used also, identifying acceptable amount of time to restore the functions, till the MTPD - Maximum Tolerable Period of Disruption of the EnCrInfrastructure organization.

IV. CONCLUSION

The needs of societal security and continuity of Czech organizations of energetic critical infrastructure are identified. The solution of crisis situation are designed and provided by the crisis continuity scenarios and methodological cycling approach understanding. Cyclic processes and procedures are outlined here. Organizational business continuity scenarios are necessary for crisis/ emergency preparedness, planning, management & coping of crisis situation in organization.

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