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WORKFLOW OPTIMIZATION FOR SAFETY PERFORMANCE

The behavioral approach [http://www.behavioral-safety.com] allows us to combine traditional methodologies of Safety Improvement and the Structured-Algorithmic Workflow Optimization with accident causing pathogens [1-12, the author publications]. This symbiosis of the proactive Trust Engineering and re-active Risk Management creates conditions for the best Safety Performance in common frameworks for system design and development. Solutions based on mathematics are more durable than solutions based on technology. Simplicity and accuracy of applied mathematics are obvious for educated and experience engineers. “If people do not believe that mathematics is simple, it is only because they do not realize how complicated life is.” – John von Neumann told. Furthermore, such solutions make us vendor-independent and customer-oriented.

Modeling and optimization help to understand problems with sufficient accuracy and solve them in the best way. In this case, misuse of terms "modeling" and "optimization" is not only undesirable but it is intolerable. Unfortunately, any illustrative and incomplete description (sketch) of the problem is common practice to call the problem "model", and any step forward in the seemingly right direction to solution improvement is commonly named "optimization". Everybody who is doubtful about my statement credibility can verify it by searching the terms in the WWW. First of all, the above-mentioned is common for hundreds publications and advertisements about workflow and business process optimization.

As one of pioneers in a workflow optimization, I am happy to know about the multi-billion dollar market [http://www.internettime.com], but as a professional I am annoyed by discrediting of the “modeling” and “optimization” terms and concepts. Beware of amateurs in engineering. They abuse your confidence. Safety and security of mission-critical processes and technologies require trust to their creators and users, as well as to advisers and consultants. We guarantee to our clients the correct modeling and optimal solution of their workflow problems, if the solution of these problems is possible and acceptable in principle. The problems of optimization based on customer-oriented modeling for business automation and data processing are being solved for a variety of criteria proposed by our clients.

The human vital functions are a decision making {a1, a2,…, b1, b2,…, c1,…) and action execution {A1, A2,…, B1, B2,…, C1,…). For simplicity sake: a decisions (a) and actions (A). Syntactic, semantic and pragmatic correct compositions of decisions and (or) actions represent a discrete and discrete-continuous processes. If the processes describe production and (or) services, then a decisions and actions are **works**. A model describing a process of decision making and action execution is called "**workflow**".

An analysis, optimization and synthesis of workflows are stages of the **workflow engineering** as well as a control, optimization and correction of work execution are stages of the **workflow management**. The greater is workflow, the less is its descriptive. The greater is workflow automation level, the less visualization is needed for automated (computer-aided) engineering or management. Semantic descriptiveness is driven out by accuracy and rigorousness. And finally, an optimization requires adequate metrics with analytical or at least statistical dependencies between them. It is why **formal (algorithmic, algebraic) models of workflow** are favored over graphic ones, but of course it does not exclude the lasts.

Let us suppose that there are several (j) modes of implementation for every functional (external) or aspectual (internal) activity A(i) of the algorithm A specifying the workflow requiring optimization.

A(i) -> { A(i, j) }, j = 1, 2, ... , n(i), j = 1, 2, ..., N.

Every possible implementation of the activity A(i, j) is characterized by the parameter vector (performance, reliability, security, etc.)

{ f(i, j), r(i1, j), r(i2, j), ... , r(iS, j) },

(where f - a goal functional, and r - aspectual requirement)

and the workflow is assessed by the parameter vector {F, R1, R2, ... , RS}, where F = F (f1, f2, ... , fN), Rk = Rk (r1k, r2k, ... , rNk).

There is a need to select the best canonical (sequential, parallel, alternative and cyclic) composition of implementation modes for activities A(i), i = 1, 2, ... , N, of the algorithm A, which results (for example) in global extremum of the goal function F in restricted limits of a parameter vector of the algorithm:

F -> extr, Rk <= Rk0, where all Rk0, k = 1, 2,..., S are defined.

The most frequently used parameters are a Time of Algorithm Execution (Performance), Probability of Correct Execution (Reliability), Safety and Security Levels, Complexity, Price, ROI (Return on Investment), etc. Of course, any one of these parameters (and also the number of functional and aspectual operators types) may be selected as the goal function F, and other parameters must fit the restrictions. In the majority of practically important cases, a workflow optimization may be simplified taking into account the features peculiar to these business, manufacture or information processes.

For example, the gradient [1] or analytic [2] techniques have found a wide utility in a Design for Performance and Design for Reliability. In more complex situations, we have been used the convex-programming [3], branch and bound method [6], dynamic programming [4], etc. Adequateness of models and techniques was tested by special investigations on stability to initial data accuracy [5] or chosen technique adequacy [3].

The unified methodology and formalized techniques for optimal trade-off between requirements to Reliability, Security and Safety of business process algorithms and process automation programs are proposed. The concept and frameworks of Structured-Algorithmic optimization are used as the basis for the methodology.

Principal dissimilarities between design and operation Reliability, Security and Safety aspects are are taken into consideration, as well as the correlations between these aspects. This leads to necessity of separation of concerns associated with the influence of no adequate modeling, design and development errors, security failures and malicious intrusions, hardware faults and malfunctions, underestimation of personal hazards and pecuniary losses.

The problems of the Reliability, Security and Safety aspect optimization also have been focused on trade-off with Performance, Accuracy, Capabilities, Power Consumption, Pricing and other parameters. The problems of stability for optimization models, techniques and programs have been formalized and investigated. Original formulations and efficient techniques for testing of business processes and data processing with and without a correcting redundancy were proposed. The software for interactive workflow optimization engineering is currently under development. Our proprietary methodology has been used commercially for design of CAM-CAD, process forecasting and decision support tools, specialized control computers, document processing, multiprocessor computer systems, etc.

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