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AUTOMATED TECHNOLOGIES AND WORKFLOW OPTIMIZATION

Once upon a time, a wise academician and admiral Aksel Berg wrote that "the Reliability Problem solved once emerges over and over again at every new step of technology development" (Cited from memory). We guess it is correct in all automation problems: level of automation, interface simplicity, performance, price, quality, reliability, safety, security, etc. It is hard to imagine some kind of human activity which is not in need of automation. It applied even to intimate part of our life, which fortunately is not the subject of this paper. And because of every automated system or technology quickly becomes obsolete, the need in automation emerges for every circuit of technical evolution. Remembering that new is a forgotten old, we shall try to use the rational composition new and old ideas to fit the contemporary technologies and systems. We also remember words of genius Viktor Glushkov that "the management complexity can't be less than the complexity of the managed object" (Cited from memory). It forces us to be responsible not only in our R & D, but also in their advertisement and promotion. First, it relates to a use (but not a manipulation) of the terms "automation", "modeling" and "optimization". Unfortunately, a lot of years ago, rush on the market replaced the natural and honest "description" and "improvement" by "modeling" and "optimization", correspondingly.

And at last about the two approaches: object orientation and process orientation. We accept all advantages of object-oriented programming for designers and developers of mass-produced software, but we can't accept this approach for unit-produced customer-oriented (personalized!) one. Any forms of human activity are ***processes*** of decision making and (or) execution independently from their nature – biological, mechanical, power, economical, informational, etc. All human attempts directed or to the best utilization of accessible to them ***resources*** during the ***process*** of a ***goal*** accomplishment, or to the ***goal*** accomplishment during the ***process*** of utilization of restricted ***resources***. The final results (as well as an intermediate results) of these processes are a ***structure*** and (or) ***behavior*** of production or consumption of products, services or a combination of the both. [4]

On each step of human activity (automated or not) a lot of natural and artificial dangers are waiting for him. Activities may be incorrectly or (and) inopportunely (but not only tardily) executed causing harm, putting to inconvenience, giving trouble and leading to unfortunate results. Many activities are preceded by solutions, and incorrect (as well as inopportune) solutions destroy an order of activity executions. Eventually, bad solutions often lead to worst consequences than bad activities. According to scale and importance of solution they may be local or global, operative or strategic. It is timely to examine and analyze the strategic solutions of information technologies oriented to automation of human activities. Almost all of them are selections for design methodology, software and hardware architecture, programming languages, operating system, database, human and network interfaces, etc. And almost all of them can be formulated as problems of optimal investment. The history of the problem solutions is so big and respectfully rewarded by Nobel prizes as well as of limited utility. No analytical models, no mathematical programming, nor games theory [12] are so much a part of engineer and economist everyday tools.

The logical-probabilistic models of Riabinin's and Solojentsev's scientific school [3, 10] made a tremendous contribution to these attempts. They can be enough if they were not restricted by at least two circumstances. First, selections are not only logical decisions but algorithmic ones, i. e. there are processes but not events. Second, even for separated decisions, forecasting of some activities is often impossible because these algorithmic (workflow) processes are stochastic Markovian processes only in very seldom (and primitive) cases.

As for market of process and workflow optimization tools, the situation is worse.

Our experiment (19.01.2005) with the Google Search Engine demonstrated that on 5,380,000 Internet pages about "business processes" there are 33,000 pages about "business process optimization" (near 0.6 per cents), on 3,790,000 pages about "business systems" there are only 191 about "business system optimization" (it is vanishing fraction), and after 1,930,000 "business objects" returns on our search of "business object optimization" we received the answer "did not match any documents". Why? Are all of these business objects ***so good*** that they don't need any optimization? But in search of "workflows", Google find 1,050,000 pages and 5,930 pages about "workflow optimization". Why? Are workflows ***so bad***? No, but they ***can*** be optimized.

The same day research with the Google tool show us that on 1,930,000 "business ***objects***" pages there are only 220,000 "business ***object***" pages. What this means? We guess that in case of "objects" theoretical (common, about an objects) reasoning predominates over practical (concrete, about the objects) ones. More optimistic, from practical point of view, situation there is in case of a business processes: 5,380,000 "business ***processes***" pages and 8,880,000 "business ***process***" pages. And, at last, "***workflow***" pages (8,430,000) are clearly predominating over "***workflows***" pages (1,050,000). This allows us to advance the hypothesis about: ***the practical use of workflows predominates over the theoretical reasoning about them.***

If we combine both of these experiments' results, we can guess that the market of "workflow optimization" has matured and it only may be needed in more methodological background, model support and adequate tools. Unfortunately, even surface analysis of hundreds publications and thousands advertisements about workflow optimization demonstrates, in the best case, attempts to locally improve simplest workflows guided by visual “models”, strongly scale restricted, badly formulized and therefore (in particular) almost useless for automation. Real workflow optimization is absolutely impossible without automation. Let us demonstrate how the Algorithm Algebra Language (AAL), which fundamentals were laid by Viktor Glushkov near 40 years ago, allow us simply and precisely describe automating and automated processes for its optimal engineering and management, correspondingly. The suite of optimization techniques was developed and tested in dozens projects. Our major problem now is to advertise and promote the common methodology and canonical models of formal workflow specifications for creation and utilization of automated technologies for goods production and service rendering. For facilitation the problem, we decide to use familiar but morbid for everybody the process of stock investing.

AAL-workflow of simplest manual screening process for single stock selection [2] looks like this:

A = A1*A2*a1(A3*a1(A4*a2(a3(A5*a4(A7 V **A6)** V **A7)** V **A6)** V **A6)** V **A6),**

where **A** – Manual Screening Process for a Single Stock;

A1 – Stock identification;
A2 – Screening with a minimum number of indicators;
A3 – Screening with additional indicators;
A4 – Fundamental analysis performing;
A5 – Technical analysis performing;
A6 – Don’t buy the stock;
A7 – Buy the stock;
a1 = 1, if the screening test was passed, and
a1 = 0 otherwise;
a2 = 1, if fundamental analysis was passed, and
a2 = 0 otherwise;
a3 = 1, if technical analysis is required by investor, and
a3 = 0 otherwise;
a4 = 1, if technical analysis was passed, and
a4 = 0 otherwise.

Logical analysis of this workflow shows us that:

If (**a1** = 1),
A = A1*A2*A3*a1(A4*a2(a3(A5*a4(A7 V **A6)** V **A7)** V **A6)** V **A6).**
If **(a1** = 0), **A = A1*A2*A6.**
If (**a1** = 1) & (**A3***a1** = 1)**,**
A = A1*A2*A3*A4*a2(a3(A5*a4(A7 V **A6)** V **A7)** V **A6).**
If (**a1** = 1) & (**A3***a1**) = 0, **A = A1*A2*A3*A6.**
If (**a1** = 1) & (**A3***a1** = 1) & (**a2** = 1),
A = A1*A2*A3*A4*a3(A5*a4(A7 V **A6)** V **A7).**

If (**a1** = 1) & (**A3***a1** = 1) & (**a2** = 0), **A = A1*A2*A3*A4*A6.**

If (**a1** = 1) & (**A3*a1** = 1) & (**a2** = 1) & (**a3** = 1),

A = A1*A2*A3*A4*A5*a4(A7 V **A6).**

If (**a1** = 1) & (**A3*a1** = 1) & (**a2** = 1) & (**a3** = 0), **A = A1*A2*A3*A4*A7.**

If (**a1** = 1) & (**A3*a1** = 1) & (**a2** = 1) & (**a3** = 1) & (**a4** = 1),

A = A1*A2*A3*A4*A5*A7.

The analysis demonstrates that almost all attempts of logic (business rules, in this case) and execution (business activities) separation had not been successful. Therefore, no "logical-determined", nor "logical-probabilistic" models can't be used for more or less complex process analysis. Comparatively simple, the one-stock selection process can be modified to multiple-stock selection. Recall that the one-stock selection workflow looks like:

A = A1*A2*a1(A3*a1(A4*a2(a3(A5*a4(A7 V **A6)** V **A7)** V **A6)** V **A6)** V **A6).**

After insertion in place of **A3*a1** the workflow

a5{A8*A3*a1(E V **A6)}*a6(A4** V **A9*a7(E** V **A6),**

where **8** – Screening criteria refining;

A9 – Scoring and ranking of passing stocks;

E – Empty operator;

a5 = 1, if more than 10 stocks passed the screening;

a5 = 0 otherwise;

a6 = 1, if less than 5 stocks passed the screening;

a6 = 0 otherwise;

a7 = 1, if the stock is ranked in the top 5;

a7 = 0 otherwise,

we obtain

A = A1*A2*a1(a5{A8*A3*a1(E V **A6)}*a6(A4** V **A9*a7(E** V **A6)**
(A4*a2(a3(A5*a4(A7 V **A6)** V **A7)** V **A6)** V **A6)** V **A6)**

with the next interpretation of conditions and activities:

A – Manual Screening Process for Multiple Stocks;

A1 – Many Stocks identification;

A2 – Screening with a minimum number of indicators;

A3 – Screening with additional indicators;

A4 – Fundamental analysis performing;

A5 – Technical analysis performing;

A6 – Don't buy the stocks;

A7 – Buy the stocks;

A8 – Screening criteria refining;

A9 – Scoring and ranking of passing stocks;

E – Empty operator;

a1 = 1, if the screening test was passed, and
a1 = 0 otherwise;
a2 = 1, if fundamental analysis was passed, and
a2 = 0 otherwise;
a3 = 1, if technical analysis is required by investor, and
a3 = 0 otherwise;
a4 = 1, if technical analysis was passed, and
a4 = 0 otherwise.
a5 = 1, if more than 10 stocks passed the screening;
a5 = 0 otherwise;
a6 = 1, if less than 5 stocks passed the screening;
a6 = 0 otherwise;
a7 = 1, if the stock is ranked in the top 5;
a7 = 0 otherwise.
In conclusion,

A = A10*a8{A8*A10}* A3*a1(E V **A6)*a5{A8*A3*a1(E** V **A6)}* a6(A4** V **A9*a7(E** V **A6) (A4*a2(a3(A5*a4(A7** V **A6)** V **A7)** V **A6)** V **A6)** V **A6)**

with the next interpretation of additional and changed conditions and activities:

A – Automated Screening Process for Multiple Stocks;
A10 – Database search with minimum number of indicators;
a8 = 1, if more than 100 stocks passed, **a8** = 0 otherwise.

In the simplest case, optimization can be formulated as the selection of numbers for conditions **a5**, **a6** and **a8** (because the numbers 10, 5 and 100 were chosen empirically). In more complex cases, we need to take into account customer (if we are brokers) requirements and restrictions.

Boolean algebra has been waiting for wide application in computer science and engineering near 100 years. We believe that the algorithm algebra, invented by Victor Glushkov [1] and reached fortieth anniversary, has a right for better destiny and we hope to maximize this opportunity. AAL was created for practical solutions of the all-important problem of automation – business process optimization, and our experience has been demonstrated not only its vitality, but great efficiency.

We also hope that this article will help to many engineers to become independent from conjuncture and conservatism of the information industry. Thousands year ago, our ancestors moved up from rock painting to inscription on stone. May be it is just in time for us to move up from intuitional flowcharts and graphs to formal workflows, from the term profanation to real modeling and optimization. People need it if only for safe, secure, reliable and economical technology automation. Victor Glushkov advocated that “nobody can automate disorder” (Cited from memory), and his AAL is the best tool for business process ordering, correct formalization and optimal automation. More details you can found in [1, 4-9, 12].

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