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The Nature & Pitfalls of Conventional Planning & Simulation

To save time and money is a constant challenge for enterprises and requires continuous strategic planning. In most cases, the same resulting questions arise and often seem to be unanswerable:

- How and where can costs be reduced or saved?
- How should a business process be structured in detail to ensure a particular operational goal?
- How can a determined process (e.g., movement of goods, return of deliveries) be optimized?
- Is a process as actually implemented really optimally organized?
- What resources are really necessary for a certain process?
- How should a process be restructured when goals and resources change?

Ultimately, all questions of this kind revolve round time, money & security

One of the central tasks in most planning consists of projecting the behaviour of processes under changing conditions into the future to recognize events which may occur and to master critical situations.

The Problem with the Dynamics

By means of so-called CASE tools, the specifications of systems or processes can easily be carried out. These specifications usually take into account only static aspects. As soon as the dynamics of a process are considered, which is the case in almost every application, conventional tools for the planning, control and visualization of processes show their restrictions. As a rule, the planning therefore concentrates on special process layouts (assumed to be optimal) with more or less reasonable assumptions about the process data. As a consequence, it is very cumbersome to represent and simulate the course of a process when process data and/or the process steps are changed.

In such a case, an improvement of process control or process optimization can be found only with prototypes or by experiments using the 'living' system. Even if both possibilities are very expensive, they nevertheless are necessary, for experience teaches us that the pure static approach causes missing elements in the specification and system faults.

The more variable-influence factors take effect in a process, the higher is the probability that planning and reality will differ from each other.

There are many proven mathematical methods, such as Petri nets or fuzzy logic, to describe real processes. Such methods, however, cannot be employed directly in planning scenarios because they are not provided by conventional planning tools.

To get usable models for practical work, there must be an as-simple-as-possible and direct connection between model and reality. With the PACE modeling and simulation environment, the real system can be precisely represented in the model, both statically and dynamically.

What is PACE ?

With PACE and its Modelling and Simulation Language MSL, almost any discrete process can be treated. The "PACE models" then provide results about the dynamic behaviour of the system components. Through this, not only can an existing process be analysed, but the effectiveness of planned actions (changes of and additions to single components) for existing processes can also be simulated and reviewed without any risk.

PACE is also a universal tool for the planning of new processes. By simulation, assumptions can be verified and uncertainty factors are checked. Faults can be discovered early in a development process and considerable cost-savings can be achieved because the elimination of development faults is, as is well known, all the more cost-effective the earlier a fault is detected.

In PACE, all process steps are shown exactly as in reality. Many design errors, like inconsistencies or missing elements, are already discovered in the modelling phase of a simulation project. Thus the understanding of the connections in the real system is also promoted. This results in more efficient operational behaviour by employees.

Processes already implemented can be continuously improved with PACE simulators. Very often unsatisfactory results of any type appear in regular business. Only the consequences, and not the origin of these results, are visible. In a reasonable amount of time, PACE can detect possible weak points, which leads to an enormous acceleration of fault diagnosis and to a considerable reduction of production failures. Bottlenecks in production processes can be defused preventatively.

For this reason, PACE increases the quality of business and production processes and provides important work data for risk management and project control.

What are the Advantages of a Process Optimization with PACE?

- Optimal use of employees by an exact determination of the number and possibly the skill of workers necessary for every process step.
- Reduction of cost factors like working times, energy consumption, wear, maintenance intervals, make-ready times.
- Safety in the planning. The consequences of selected “what if?“ situations are already predictable at the planning.
- Process visualizations. The relevant processes within your business and their connections are visualized in detail. You can proceed preventatively with respect to the running process instead of reacting if "something has happened".

“ The real strength of PACE is the ability to determine the optimum of a process “

For a production process the following example describes a typical task:

„"Adjust" the process so that an optimal state is achieved with regard to the following aims

- Sales profitability
- Throughput
- Continous execution without interrupts
- Defective rejects minimization

Cause an adjustment by change of following parameters:

- Working times / wage costs / wage additional costs
- Material
- Use of machines

With PACE the optimal process parameters are found automatically.

List of References:

PACE is used in more than 450 universities, scientific institutes and industrial companies.

International education and research facilities count on PACE's unique possibilities primarily in the areas of education, research and development.

- Chaoyang University of Technology, Taiwan
- ETH Zürich
- Fachhochschule Dortmund
- Fachhochschule Erfurt
- Fachhochschule Gießen
- Fachhochschule Landshut
- Forschungsverbund Logistik
- Forschungszentrum Karlsruhe
- National Pingtung University, Taiwan
- National Taipei University, Taiwan
- Polytechnic of Namibia
- SunMoon University, South Korea
- Tatuing University, Taiwan
- Technische Universität Hamburg
- Universite de Haute-Alsace
- Universität Kassel
- Universität Hamburg-Harburg
- Universität Karlsruhe
- Universität Magdeburg
- Universität Mannheim
- Universität Santiago de Chile
- Universität Valparaiso de Chile
- Universität Würzburg
- ZbW, St. Gallen

In the commercial environment, numerous enterprises have realized process planning and optimizations with PACE, for example:

- Deutsche Bahn AG
- Deutsche Telekom
- EADS, Friedrichshafen
- EPCOS, München
- Fraunhofer IMS, Duisburg
- Fraunhofer IAO, Stuttgart
- GPP, Chemnitz
- IABG, Ottobrunn
- SABU Gas Corporation, Japan
- VISHAY BCcomponents

Reference contacts are available on request.

Strengths and Features of PACE

- PACE is a software tool for the modelling of complex processes with many dynamic components. PACE is universally usable -- among other things, with production processes, money streams, processing cycles, provision scenarios, automatisms, etc.

- PACE is based on scientific principles. The subdivision of PACE models into statics and dynamics permits modelling suitable for engineers and makes an adequate system description possible.

- Modeling of processes up to an arbitrary depth. The user, not the software tool, decides on the detail depth and detail faithfulness! Systems can be represented based on reality, both spatially and with regard to the contents.

- PACE models are formulated as so-called High-Level Petri nets. The developer can organize the net hierarchically, or can organize the application surface in such a way that only the relevant model constituents are shown on the screen.

- Modular representation and ordering of partial system components with certain hierarchies within a large system.

- Almost arbitrary use of stock data (as a simulation basis) in electronic form (e.g., databases or Excel tables) with integrated interfaces.

- Data processing is carried out in a user-friendly notation.

PACE Technics

→ High Level Process Animation & Visualization

This is comfortably carried out via an easily operated graphic editor. Moreover, there is a standardized set of visualization components -- both for the input of data and for the representation of the results of a simulation (e.g., Bar Gauges, pie diagrams, curves, instruments, buttons, slider, wheels, etc.).

Alternatively one's own graphics can be used for the visualization of processes. An excellent understanding of the process behaviour becomes possible with that.

→ Flexible Simulator

The simulator can run either in the background or in the animation mode with selectable speed (single-step is also possible).

The simulation can be repeated as often as desired with different parameter sets (also with results already achieved in previous simulations).

→ Integrated Debugger

The debugger allows the user to save and to restore the status of the complete system or of single modules automatically. Moreover, one can install and uninstall temporal and spatial break points.

→ Probability Distributions

For the construction of stochastic models numerous discrete and continuous mathematical probability distributions are available.

Moreover, empirical probability distributions of one's own can be made directly from measurements.

This feature is unique and at present only available in PACE.

→ Fuzzy Logics

Another outstanding feature of PACE is the processing of unsharp values. Fuzzy controllers are frequently used in the organisation of processes where the algorithmic connection between the process parameters is very complex and non-transparent, only qualitatively known, or completely unknown.

So-called "linguistic variables" allow the integration of empirical values (e.g., review of intermediate results) in a model.

→ Optimization Methods

Due to the 'net functions' proposed by IBE and implemented in PACE, for the first time exact mathematical optimization procedures can be used for the best possible construction of the modelled systems. A sequence of optimization procedures is provided (e.g., Hill Climbing, Simplex, Genetics), which can be used singly or in sequence.

These optimization procedures can be used with the complete model as well as for the optimization of single modules (submodels).

This feature is unique and at present only available in PACE.

Offers

Software Licenses

Every licence entitles the licensee to installl PACE on one single computer. It may be used by several users of the computer at different times.

Besides the single computer licenses there are also licences for multiple installations and for companies. Please inquire for our price list and/or for an customized offer.

Services

Parallel to the sale of the PACE licences, we also offer target-oriented consulting. We would be glad to show you our solution proposals for your open questions in a personal conversation -- in connection with a demonstration of PACE.

As a rule, a process optimization with PACE can be divided in four phases:

Phase 1: Knowledge Acquisition

Together with you, we get to know your business operations and processes and define the goals which are to be accomplished by a simulation.

Phase 2: Modeling

Following this, we make a model of your business process incorporating all available or planned relations.

Phase 3: Simulation

After the development and the verification of the model, it is executed with varying parameter sets. This delivers the correspondence between input parameters, configuration data and results, and shows their dependencies and optimal settings.

Phase 4: Result Evaluation and Documentation

Evaluation and report. The simulations allow a very exact determination of costs and of the use of planned processes or changes. The results of the simulation with respect to the requested goals are investigated.

The model developed by us of your business processes has a simple user interface and is at your disposal also for future planning and future optimizations.

A simulation with appropriate evaluation of the results by our staff is a purposeful measure to recognize acute or hidden problems in your enterprise and to start counteractions, or to support or check from a neutral point of view and, if necessary, improve existing planning of a new process scenario.

Training

We also provide on-site training on request to guarantee experienced use of the PACE system as quickly as possible. Among other things, the following subjects are covered:

- Basics of modelling and simulation
- Development of models
- Efficient modeling with PACE

Depending on the requested training depth and the previous experience of the participants, the courses last between three and five days.

We recommend on-site training because company-specific problems and upcoming company-specific development plans are usually discussed during the courses, too.

System Requirements

PACE models & simulations can be executed with most standard business computers (with the Microsoft Windows 2000 / XP / Vista operating system). For performance reasons we recommend a computer with at least 512 MB memory and with 2.0 GHz or more.

The PACE system allows the graphic modelling of systems with hierarchy levels. Representation in PACE is based on "Windows" technology. We therefore recommend a screen size of at least 17 inches for the development of larger models. However, smaller models can also be developed and executed on a standard notebook computer.

PACE is available in English or German and has been constantly developed and updated since 1994. The newest version (PACE 2008), with numerous new features, has been released in March 2008.

Contacts

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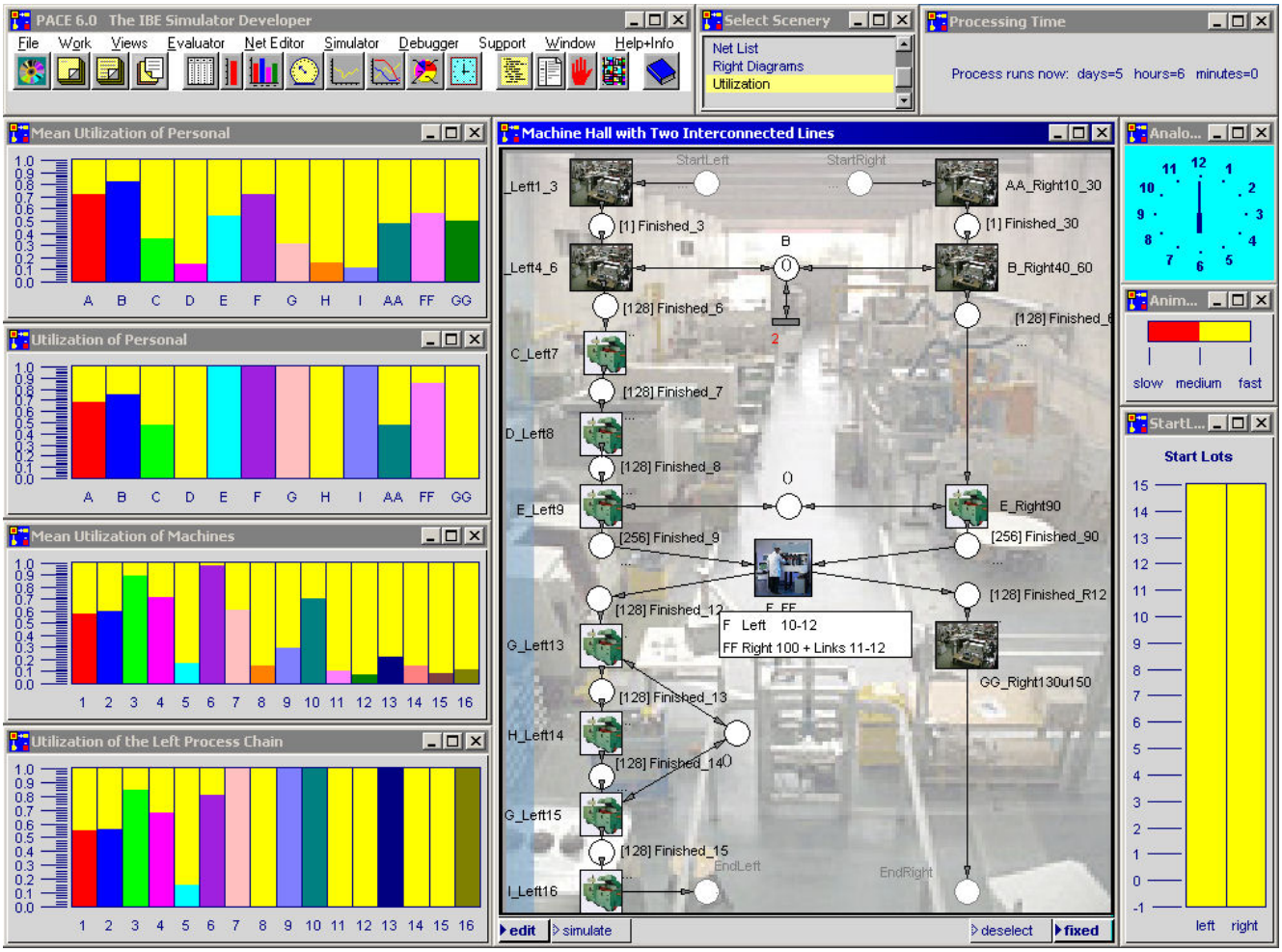
Example from the Practice

Machine Hall with Two Interconnected Lines

Planning, Controlling and Optimizing production lines



The planning of production chains is a very frequently occurring task and is carried out till now in most cases without the use of dynamic planning tools. Through this frequently considerable saving potentials remain unused because they cannot be treated at all in the frame of a purely static design procedure. By inclusion of PACE in the planning one can already determine the possible productivity of the resources at a very early point of time and examine the performance of the production lines by parameter changes (e.g. size of the buffers between the machines) or by configuration changes. The planning delivers thus well operating, if not even optimal production chains; surprises do not appear at the later commencement of the installation any more.

In the above example of two connected production lines the productivity of the employees and machines is determined by simulation of the complete production hall and displayed in multiple bar gauges graphically. The two lines are coupled in multiple ways with each other. A skilled worker is employed for both chains at two places, one machine is needed for both chains. By application of the optimization methods provided by PACE a set of production parameters is calculated which leads to a very good performance of the installation.

In addition to the planning PACE also can be used for the online controlling of the current situation by connecting it to the external production database. The simulation model can recognize and predict bottlenecks occurring as a consequence of the current situation in the production and can suggest preventive measures.