

WoPeD 2.0 goes BPEL 2.0

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***Abstract.** WoPeD (Workflow Petrinet Designer) is an easy-to-use, Java-based open source software tool being developed at the University of Cooperative Education, Karlsruhe. WoPeD is able to edit, simulate and analyze workflow nets, providing a useful instrument in particular for research and educational purposes. This paper gives an overview to the current features of the tool, in particular on the newly-added BPEL export and coverability graph visualization capabilities which will be part of the next major release 2.0*

What is WoPeD?

WoPeD is Java-based and supports the class of workflow nets as well as standard place/transition nets. WoPeD is strictly supporting the well-established "van der Aalst" notation [Aal02] and can visualize both structure and dynamics of workflow processes, helping to get a deeper and more intuitive understanding of the underlying theoretical concepts. WoPeD mainly focuses on educational, scientific and publishing purposes in the field of Petri net-based workflow modelling. WoPeD is open source and freely-available. Source code and installer packages are provided via Sourceforge¹, a common platform for the distributed development of free software projects. Several publications have accompanied the emerging development of the software, giving additional information on the underlying architecture [FrL03], on used algorithms [Eck06] and on visualization concepts [FIF06]. A new major release will be released in the fourth quarter of 2008. The rest of this paper gives a brief overview on the most important features of WoPeD, with special focus on new functions which will be part of the new major release 2.0.

Process and resource view editors

The WoPeD editor offers full support for the class of workflow nets including operators, triggers, sub-processes, resource assignments and quantitative parameters like task service times or branching probabilities of XOR-splits. In addition, WoPeD contains a separate graphical resource modelling editor to define resource classes (groups and roles) and their contained resource objects (workflow participants).

¹ <http://sourceforge.net/projects/woped>

Within the process model, each resource-triggered transition can be associated with one role and one group. The standard file format of WoPeD is PNML [WeK03], allowing model exchange with other Petri net tools. For convenient import into other

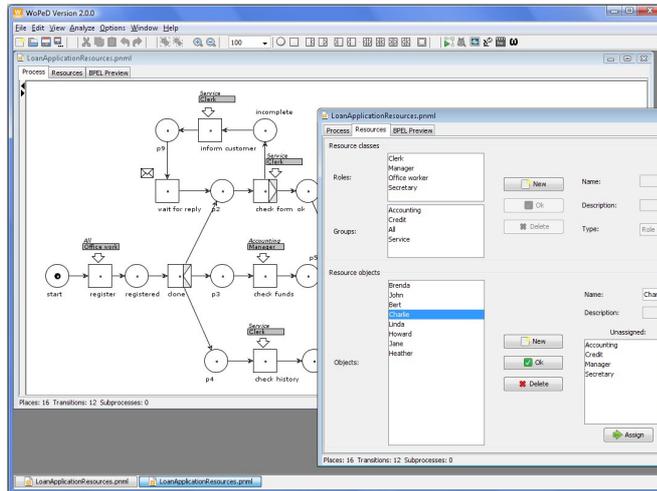


Fig. 1

Process and resource editor

tools supporting PNML, complex operators in "van der Aalst" notation are expanded automatically into their Petri net primitives. WoPeD supports several export interfaces, including JPEG, BMP and PNG graphic formats.

Exporting workflow nets to BPEL

An important new feature of WoPeD 2.0 is exporting well-structured, free-choice workflow nets into the widely-used BPEL format. The process control flow is converted to the associated BPEL constructs and single transitions can be used as placeholders for basic BPEL operations (*assign*, *invoke*, *receive*, *reply*, *wait*). A

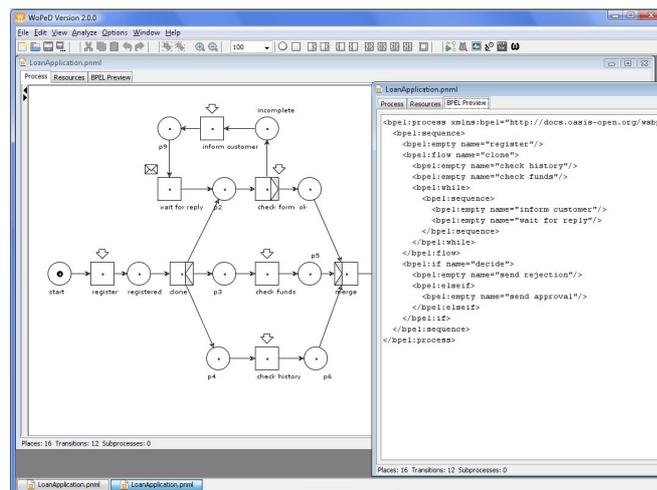


Fig. 2

BPEL 2.0 export tab

global namespace is supported for defining state variables which can be used as parameters when interacting with web-services. By this, WoPeD allows the orchestration of arbitrary web services identified by partner links as well as their import from UDDI business registries. The parser used to convert the workflow net control flow into a executable BPEL script is based on the ideas published in [AaL08] and [Las06].

Sound sub-process support

WoPeD allows hierarchical editing of sub-processes. Any transition of a workflow net can be an abstraction of another workflow net, symbolized by a special, double-framed sub-process transition symbol. By this, even large workflow process models can be managed by splitting them up into small portions. As a restriction, WoPeD forces all sub-processes to be workflow nets, such that only subnets with exactly one input and one output place are supported. This has the interesting consequence that

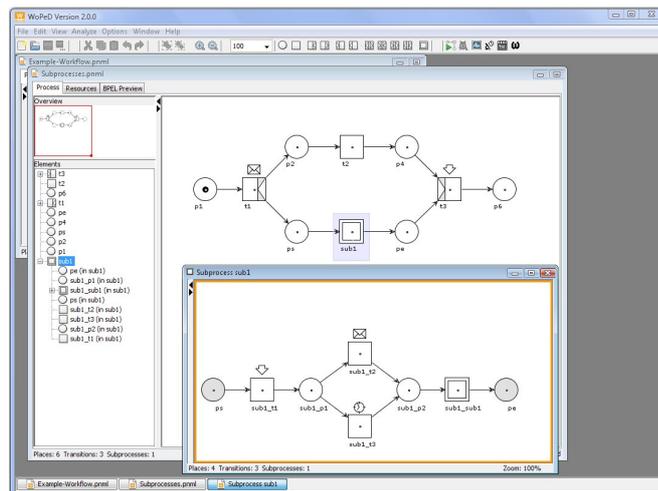


Fig. 3

Sub-process editor and process tree view

most qualitative and quantitative behaviour properties (like e. g. soundness) can be checked locally on sub-process level and the results can be recursively exported to the embedding process levels. Currently, the composition of the analysis results must be done manually. A future version of WoPeD will be able to automate this task by creating a hierarchical analysis report over all sub-processes.

Enhanced simulation control

WoPeD provides an animated token game simulation for navigating through the reachable markings of a workflow net. The new version 2.0 contains an improved interface to navigate both forward and backward, step into or step over sub-processes and automatically proceed to the next conflicting marking. Apart from this, WoPeD allows recording and playback of simulation sessions as well as saving them for later

reference. A comfortable "remote-control"-like widget in three different views (standard, compact and "iPod") is provided in order to control all these activities.

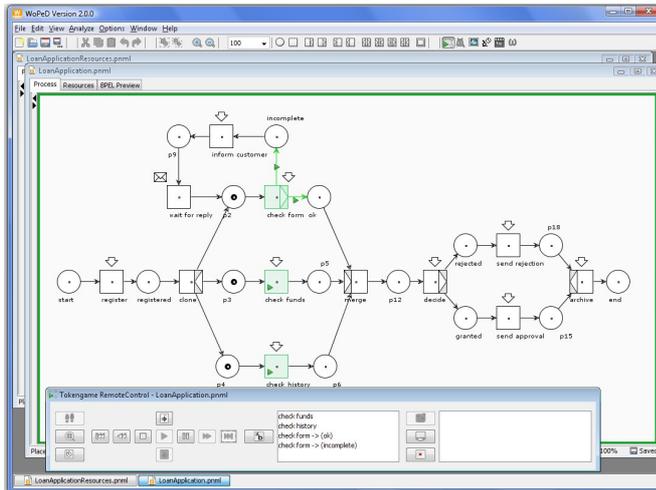


Fig. 4
Simulation
"remote control"

Qualitative analysis and visual debugging

WoPeD can analyse a variety of qualitative, soundness-related properties, e. g. free-choice, S-component coverage, well-structuredness, boundedness and liveness. Almost all properties are checked by built-in algorithms, except for some runtime

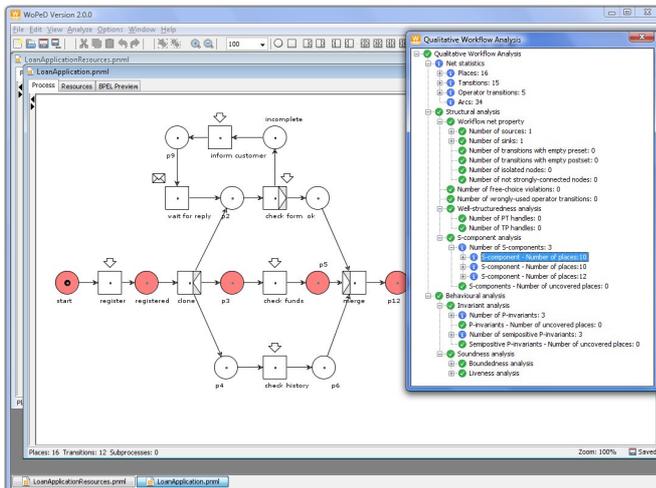


Fig. 5
Visual debugging
of net properties

consuming parts of the soundness check which are computed by using Woflan [VBA01] [Wof08] transparently as an external library. This allows the direct graphical

visualization of the analysis results inside the associated workflow net, making WoPeD a powerful visual debugging tool for workflow process definitions.

Automated coverability graph creation

The new release 2.0 of WoPeD implements automatic reachability and coverability graph construction and visualization. Two simple layout algorithms are implemented

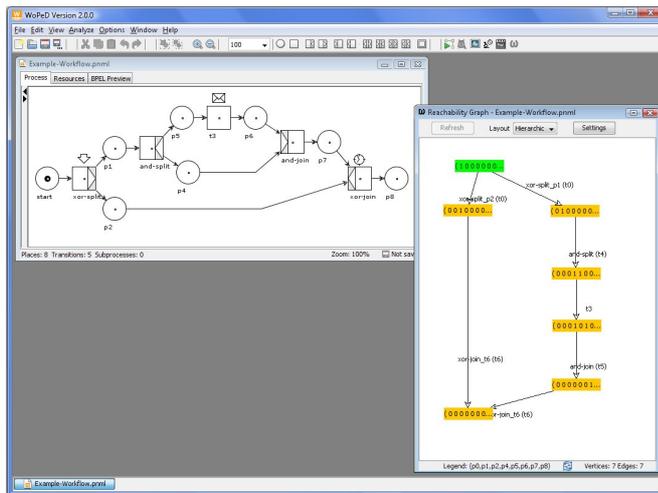


Fig. 6

Coverability graph visualization

to allow a visual representation. To facilitate the creation of visually appealing graph representations, the software allows users to adjust node positions according to their needs. Once displayed in a satisfying way, the coverability graph can also be exported to the most common graphics formats such as JPEG, BMP and PNG. By this, WoPeD can be used to create sample graphs e. g. for lecture material or other publications.

Task	Service time	Items/case	Time/case	Items/period	Time/period	Group / Role
contact departmen...	15.00	1.00	15.00	50.00	750.00	Complaints/Empl...
contact client (C)	10.00	1.00	10.00	50.00	500.00	Complaints/Empl...
check (K)	20.00	1.11	22.22	55.56	1111.10	Complaints/Manager
read (R)	6.00	0.21	6.67	5.56	33.33	Complaints/Empl...
pay (E)	10.00	0.70	7.00	35.00	350.00	Finances/Employee
send letter (L)	25.00	0.30	7.50	15.00	375.00	Complaints/Empl...
Whole process			62.39		3319.42	

Resource class	Aggregate time	Min. number of resource objects
Complaints	2769.42	7.21
Finances	700.00	0.90
Manager	1111.10	2.89
Employee	2099.32	5.25

Fig. 7

Capacity planning report

Quantitative analysis and capacity planning

WoPeD is able to store and visualize an average service time value with each resource-triggered transition and an average branching probability with each outgoing arc of an implicit or explicit XOR-split operator. Based on the role/group assignment to all contained tasks, this allows the computation of a capacity planning table derived from both process and resource model, assigning each transition the expected number of work items per case, and each resource class the minimum required number of members under a given resource utilization rate. The algorithm to compute the number of work items per case is based on a special sort of net unfolding which is capable to approximate possibly infinite loop behaviour.

Conclusion and outlook

WoPeD is an evolving software tool. The editing component supports a process model view as well as a resource model view and a functional view (currently BPEL code). WoPeD strictly supports the original workflow net notation and contains algorithms for checking qualitative properties (soundness) as well as quantitative properties (capacity planning). By this, WoPeD is an instrument for "blended learning" in the context of teaching and publishing in the area of workflow management and process analysis. Future development will focus on an enhanced resource model editor, a more powerful coverability graph visualization and more additional process debugging and analysis functions. For further information, including announcements of new features, download links, screenshots and documentation, please refer to the website [WoP08].

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