13th Int. Workshop on Generalized Nets
London, 29 October 2012, 24–33

Generalized net model of an online submission system

Vassia Atanassova

Bioinformatics and Mathematical Modelling Dept.
IBPhBME, Bulgarian Academy Sciences
105 "Acad. G. Bonchev" Str., Sofia–1113, Bulgaria

Intelligent Systems Dept., IICT, Bulgarian Academy Sciences
2 "Acad. G. Bonchev" Str., Sofia–1113, Bulgaria
e-mail: vassia.atanassova@gmail.com

Abstract: An application model of an online submission system is constructed, using the apparatus of generalized nets. The aim is to show how the online submission system provider, the conference organizers and the end users (in their different roles of authors or reviewers) interact and exchange information, and to locate certain aspects of these interactions that can be subjects of improvement. Using different characteristics of its information carriers, the model can be tuned to serve the needs of either the online submission system provider or the conference provider. This may include some traits of proactive intelligent behaviour of the model, which is able to locate certain problems that end users may suffer and timely prompt the respective service provider to solve them or take appropriate decisions. Thus, the model serves as a simple but illustrative example of various possibilities offered by the apparatus of generalized nets for description and management of parallel processes in a context which should be rather familiar to all readers.
Keywords: Generalized nets, Online submission systems, Human-machine interface.
AMS Classification: 68Q85.

1 Introduction

The particular motivation behind this work were some common problems and failures that users of online submission systems (OSS) often experience. Being a 'system' in the broad sense of that term is already a good enough motivation for us to try to describe a general model of online submission systems using the instrumentation of generalized nets (GNs, [1–3]). Specifying the perspective, from which the model is designed, we take decisions of which of the information flows within this system will be on focus, and thus we will be able to seek solutions with respect to the particular problems that have arisen and finely tune the system to recognize them and intelligently react.

We have chosen to use the apparatus of GNs in its capacity of a flexible and scalable tool for modelling of processes that involve parallelism and concurrency. GNs are notable with their intuitive graphic component and the transitions index matrices, which encode the logic behind the movement of dynamic tokens within the GN's static infrastructure.

The paper is organized as follows. Section 2 describes the main roles and functionalities occurring in an OSS. Section 3 'translates' this information in terms of a GN model. The Conclusion generalizes how, if run in practice, the model may deliver valuable feedback to the interested parties, needed for optimization of the services which they provide.

2 Overview of online submission systems

Online submission systems for research conferences and journals are web platforms for management of the overall process of submission of original research papers by their (corresponding) authors for participation in conferences, and reviews made by officially designated reviewers. Some OSSs include extra features like organization of conference sessions, printing of CD-ROMs, schedules and badges, etc. Some conference organizers and journals use their own submission systems, other rely on OSS providers, like EDAS [4].

In the later case, which we are going to consider, the whole process of articles submission involves three parties (roles): the OSS Provider, the Conference Organizer (CO) and the End User, in his capacity of author, who submits article(s) for participation in the conference, or reviewer, who estimates the quality and relevance of the submitted works (one user may accommodate both roles at a time, even for one and the same conference). Different factors contribute to the presence of parallelism in the model: an OSS is capable of maintaining multiple conferences at a time, while COs, naturally, expect the submission of a number of articles. Moreover, there are temporal limitations that also need to be taken into consideration.

Information flows on different levels within this system. The CO contacts an OSS Provider defining certain parameters of the conference and the documents that are to be considered eligible for submission. These details may include deadlines for submission and review, percentage of selectivity, number of papers per person allowed, number of reviewers per paper, reviewing mode (single-blind, double-blind), completed copyright form, a well as some technical requirements like file format, file size, number of pages, paper size, margins, styles, fonts, length of abstract, keywords, references. A set of these parameters may be required to set up a new event in the OSS.

On the other hand, the CO makes efforts to invite some of the outstanding specialists in the subject area(s) of the conference for keynote speakers and reviewers, as well as to broadly announce the conference and attract potential participants – both authors and listeners. The size of the directly and indirectly reached audience reflects in the number of submission, out of which selection is made, and thus reflect in the quality and significance of the event. These information flows, despite not being an integral part of the OSS, will be acknowledged and included in our GN model.

Once a conference has been set up within the OSS, end users can authenticate and log in. A regular user, i.e. author who applies for the conference, can submit his work under the condition that the predefined technical requirements are met.

If the user is assigned the role of a reviewer by the CO, he will access a user interface that is different from the one the author interacts with. Reviewers are provided access to a list of submitted papers that are pending review, and are required to return their opinion to the CO. Depending on the particular conference policies for determining the final decision, which are not a subject of discussion here, the reviewing process ends by sending the author of a notification of acceptance or rejection of the submitted work, as well as an eventual list of remarks that are to be taken into consideration in cases of acceptance including minor or major revision. This feedback determines whether the author is supposed to continue interacting with the OSS or not, in case of rejection of his submission.

There are, however, certain situations when feedback may flow from the author to the CO or the OSS, too. For instance, the OSS may report errors that prevent otherwise correctly typeset articles from effective submission, the reason being in either mismatch of the article templates and the criteria for successful article check, and/or some software bug in the OSS. Users may choose to contact the CO or directly the OSSP, reporting the system misbehaviour and thus trigger respective actions. Moreover, if users do not contact the CO or OSSP, they will probably never understand of the problems. The system, however, should be able to collect information about the successful and unsuccessful attempts for article submission, and in case of repetitive patterns of failure with multiple users, measures have to be taken for proactively prompting the CO and OSSP to resolve the problems occurred.

3 Generalized net model of an online submission system

The concept of generalized nets (GNs) extends the concept of Petri nets (Place-transition nets) and all of their extensions and modifications by 1982. Since then the theory of GNs has been developing, enriched with an algebraic, topological, operator, programming, methodological and, since recently, didactical aspects. The applications of GNs occur as early as the first theoretical results, and so far there are applications in as many and diverse areas as medicine and biotechnologies, physics and chemistry, industry and economics, engineering and telecommunications, software development and validation.

All necessary definitions of GNs and their building blocks, the transitions, are given in [2, 3] and are not to be discussed here in details.

Here, as illustrated in Figure 1, we will consider a GN model containing six transitions, which correspond to the following aspects of the above described OSS:

- Z_1 represents the OSSP;
- Z_2 represents the conference organizer, in general;
- Z_3 represents the conference's OSS in a subspace of the overall OSS, set up according to the CO's preferences;
- Z_4 represents the pool of potential authors, some of who do take part in the process by submitting papers;
- Z_5 represents the process of article submission and partly the reviewing process;
- Z_6 represents the completion of the reviewing process and the system feedback.

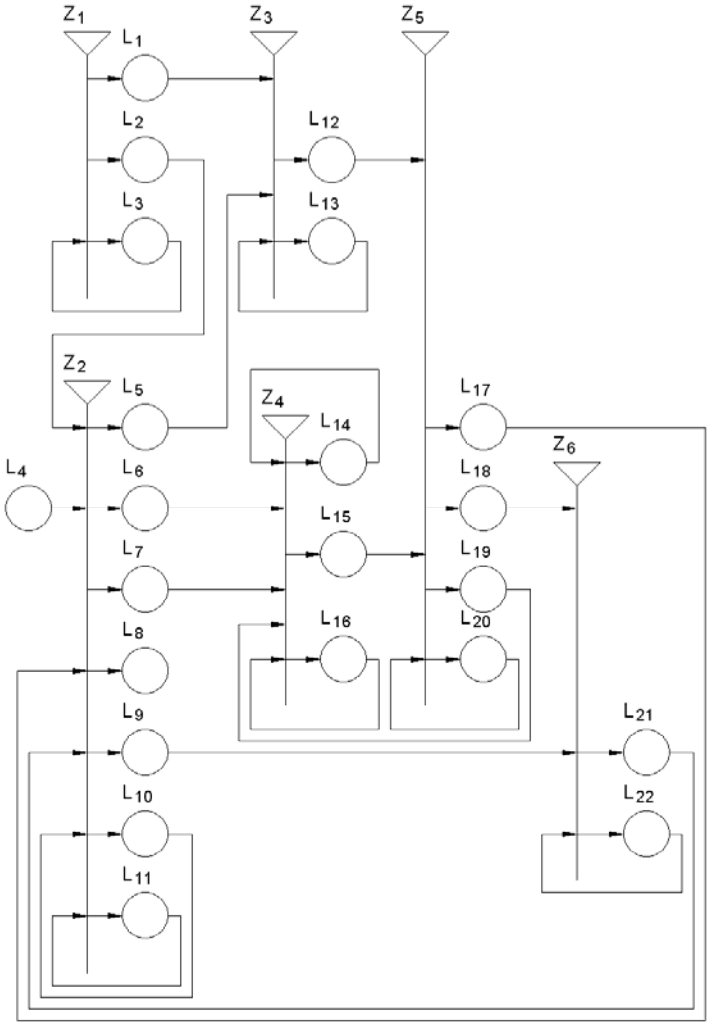

Figure 1: GN model of an online submission system

In this work, for simplicity, we have chosen to construct the model from the perspective of the CO, rather than from the perspective of the OSSP. With this provision, we will only consider the case when the model contains one OSSP, one CO and multiple end users. This will reflect in the formulations of the characteristics of the tokens, moving within the net, as well as the information which they carry along the way. If we would like to draw the model from the perspective of the OSSP, then we should allow that not only multiple users, but also that multiple COs take part, but in this case the net tokens have to be charged with different token characteristics and problems of different nature would be more important to solve, mainly related to resource allocation and management.

The model contains 22 places, four of which are global input places of the net, namely, L_3 with one ν-token representting the OSSP; L_4 with one κ-token representing the CO; L_{14} with one α-token that contains the list of the potential authors, and L_{10} with one ρ-token that contains the list of the potential reviewers.

Several types of tokens are moving within the net: a ν-token staying for the o**n**line submission system provider, κ-tokens for **c**onference organizers, α-tokens for the **a**uthors, ρ-tokens for the **r**eviewers, π-tokens for the **p**apers submitted, o-tokens for the reviewers'

opinions (reviews), φ-tokens for the **f**inal opinions for the submitted papers, β-token for the conference **b**ook; σ-tokens for **s**ystem requirements, ε-tokens for **e**rror reports, μ-tokens for system **m**essages, ξ-tokens for the announcements.

Let us start describing the model by describing its transitions. For every transition, four components will be provided: the set of input places, the set of output places, definition of the index matrix of predicates, and the Boolean expression, denoting those of the input places for the transition that must obligatory contain tokens for the transition to become active.

Transition Z_1 has the following form:

$$Z_1 = \langle \{L_3\}, \{L_1, L_2, L_3\}, M_1, L_3 \rangle$$

where

$$M_1 = \begin{array}{c|ccc} & L_1 & L_2 & L_3 \\ \hline L_3 & W_{3,1} & W_{3,2} & true \end{array},$$

and the predicates in the index matrix M_1 have the following meaning:

- $W_{3,1}$ = "there is a request from a CO to use the OSS of the OSSP";
- $W_{3,2}$ = "it is necessary to submit information to a CO about the requirements of the OSS".

Initially in place L_3, which is one of the global inputs of the net, a ν-token stays with the characteristic "OSS specification, OSS source code, OSS requirements, etc." When a request is received from a new CO for information about the services, provided by the OSSP, the ν-token staying in place L_3, splits into two tokens, one of which being the same token remaining in place L_3, and the other one being a σ-token that transfers to place L_2 with the characteristic "list of OSS requirements".

When the actual request for using the OSS comes, the OSSP sets up a subspace within the OSS, serving the needs of the CO. This happens by splitting of the ν-token staying in place L_3 into two tokens, one remaining with the same characteristic in L_3 and another that transfers to L_1 with the characteristic "new subspace of the OSS is initialized for the CO".

Transition Z_2 has the following form:

$$Z_2 = \langle \{L_2, L_4, L_{10}, L_{11}, L_{17}, L_{21}\}, \{L_5, L_6, L_7, L_8, L_9, L_{10}, L_{11}\}, M_2, \wedge(L_2, L_4) \rangle$$

where

$$M_2 = \begin{array}{c|ccccccc} & L_5 & L_6 & L_7 & L_8 & L_9 & L_{10} & L_{11} \\ \hline L_2 & false & false & false & false & false & false & true \\ L_4 & false & false & false & false & false & false & true \\ L_{10} & false & false & false & false & W_{10,9} & true & false \\ L_{11} & W_{11,5} & W_{11,6} & W_{11,7} & W_{11,8} & false & false & true \\ L_{17} & false & false & false & false & false & false & true \\ L_{21} & false & false & false & false & false & false & true \end{array},$$

and the predicates in the index matrix M_2 have the following meaning:

- $W_{10,9}$ = "the conference committee has assigned reviewers for the papers that have been successfully submitted (in place L_{20})";
- $W_{11,5}$ = "the CO define criteria for the technical check for validity of the submitted papers, made by the OSS";

- $W_{11,6}$ = “the CO reaches the general public with announcements of the conference”;
- $W_{11,7}$ = “the CO notifies the authors of their final opinion about the submitted papers (acceptance, minor/major revision, rejection)”;
- $W_{11,8}$ = “the reviewing process is over and the CO has the final version of all papers for the conference proceeding”.

When the list of reviewers is specified, i.e. predicate $W_{10,9}$ is “true”, the ρ-token in place L_{10} splits into two tokens: one remaining in place L_{10} and the other one entering place L_9 with the characteristic “list of the reviewers, assigned to review the submitted papers” (we assume that each paper is reviewed by more than one reviewer and the list contains entries in format “paper ID, reviewer #1, …, reviewer #*n*”).

When $W_{11,5}$ is “true”, the κ-token in place L_{11} splits in two, one token remains in L_{11} and the other one transfers to place L_5 with the characteristic “criteria for the technical check for validity of the submitted papers”. Notably, in some cases (preceded by the system sending ε-tokens with error reports, see definition of Z_5 below) it is possible that this token transfer is done not only in the beginning, but also on later stages of the online submission process, depending on feedback from the users about problems occurring while using the system.

When $W_{11,6}$ is “true”, the κ-token in place L_{11} splits in two tokens, one of them, again κ, remaining in place L_{11} and the other one, a ξ-token, transfers to place L_6 with the characteristic “announcement of the conference (call for paper) to the general audience of potential authors”.

When $W_{11,7}$ is “true”, the κ-token in place L_{11} splits in two tokens: one of them is the original κ-token that stays in place L_{11} and the other one is a φ-token that moves to place L_7 with the characteristic “paper ID, final opinion of the conference committee based on the reviewers’ opinions about that paper”.

When $W_{11,8}$ is “true”, the κ-token in place L_{11} splits in two tokens: one of them is the original κ-token that stays in place L_{11} and the other one is the β-token that transfers to place L_8 with the characteristic “the conference book as a collection of all papers accepted by the conference committee”.

Transition Z_3 has the following form:

$$Z_3 = \langle \{L_1, L_5, L_{13}\}, \{L_{12}, L_{13}\}, M_3, \wedge(L_1, L_5)\rangle$$

where

$$M_3 = \begin{array}{c|cc} & L_{12} & L_{13} \\ \hline L_1 & false & true \\ L_5 & false & true \\ L_{13} & W_{13,12} & true \end{array},$$

and the predicate in the index matrix M_3 has the following meaning: $W_{13,12}$ = “specific settings of the conference OSS are made (paper templates, criteria for technical validity, etc)”.

In place L_{13}, a ν-token from place L_1 enters together with a κ-token from place L_5 and they merge there in a new token σ with the characteristic “general system settings of the OSSP, specific settings of the OSS subspace dedicated to that particular conference”. When the predicate $W_{13,12}$ is “true”, the σ-token in place L_{13} splits into two tokens, one identical that remains in place L_{13} and another that transfers to place L_{12} with the characteristic “specific settings of the conference OSS (paper templates, criteria for technical validity, etc)”.

Transition Z_4 has the following form:

$$Z_4 = \langle \{L_6, L_7, L_{14}, L_{16}, L_{19}\}, \{L_{14}, L_{15}, L_{16}\}, M_4, \wedge(L_2, L_4)\rangle$$

where

$$M_4 = \begin{array}{c|ccc} & L_{14} & L_{15} & L_{16} \\ \hline L_6 & true & false & false \\ L_7 & false & false & true \\ L_{14} & true & W_{14,15} & W_{14,16} \\ L_{16} & false & W_{16,15} & true \\ L_{19} & false & false & true \end{array},$$

and the predicates in the index matrix M_4 have the following meaning:

- $W_{14,15} = W_{14,16}$ = "a potential authors has prepared a paper for participation in the conference";
- $W_{16,15}$ = "the author has prepared a new version of his paper, with respect to the error report for the technical correspondence of the previous version with the criteria for validity set by the CO".

The ξ-token from place L_6 merges with the α-token in place L_{14} that represents the potential authors.

On the next time-step, if predicate $W_{14,15} = W_{14,16}$ = "true", this will corresponds to the situation when one of the potential authors have prepared a paper for participation in the conference. This results in the α-token from L_{14} splitting into three tokens: a new token π that represents the prepared paper (registered in the OSS with a numerical identifier) and moves to place L_{15}, a new α^*-token that represents that paper's author and moves to place L_{16}, and the former α-token that remains in place L_{14} with an updated characteristic "list of potential authors, with the name of the author in α^* removed from the list". The reason for this change in the token characteristic is obvious: an author who has already prepared a paper for submission to a conference is no more in the pool of its *potential* authors, but is treated as an *effective* one.

If predicate $W_{16,15}$ is "true", this reflects the situation when the author prepares a new version of his paper for submission to the OSS. The need for doing so is due to the fact that a previous version has not passed the technical check for validity and correspondence with the conference criteria for submission (see the definition of transition Z_5). As coded in the value "true" in cell $L_{19}\times L_{16}$ of the index matrix M_4, the system notifies the user (in the form of an ε-token from place L_{19}) of the particular errors in the document (identified by a numerical identifier) that have lead to unsuccessful submission. So, when $W_{16,15}$ is "true", the α^*-token representing the author of paper with that identifier splits into two tokens: one being the same α^*-token that remains in place L_{16}, and the other one being a π-token for the new version of the paper with that identifier, that moves to place L_{15}.

Transition Z_5 has the following form:

$$Z_5 = \langle \{L_{12}, L_{15}, L_{20}\}, \{L_{17}, L_{18}, L_{19}, L_{20}\}, M_5, \wedge(L_{12}, L_{15})\rangle$$

where

$$M_5 = \begin{array}{c|cccc} & L_{17} & L_{18} & L_{19} & L_{20} \\ \hline L_{12} & false & false & W_{12,19} & W_{12,20} \\ L_{15} & true & false & W_{15,19} & W_{15,20} \\ L_{20} & false & W_{20,18} & false & false \end{array},$$

and the predicates in the index matrix M_5 have the following meaning:

- $W_{12,19} = W_{15,19}$ = "the submitted article is not prepared in accordance with the technical requirements of the CO";
- $W_{12,20} = W_{15,20}$ = "the submitted article is prepared in accordance with the technical requirements of the CO", i.e. predicates $W_{12,20}$, $W_{15,20}$ are identical with the negation of predicates $W_{12,19}$, $W_{15,19}$;
- $W_{20,18}$ = "the conference committee has assigned the paper to (two or more) reviewers".

When a new article is registered in the system, i.e. a new π-token enters place L_{15}, in place L_{12} is loaded a σ-token with the current technical requirements which the CO demands from the submitted papers via the OSS. These technical requirements may be observed by the authors, and in this case, i.e. predicate $W_{12,20}$ being "true", the paper is collected in the OSS database, represented by the π-token moving to place L_{20}. In the same time, a message about the successful submission is sent to the CO (see the predicate "true" in cell $L_{15}\times L_{17}$ of the index matrix M_5), in the form of a μ-token containing as token characteristics the paper identifier in the OSS, its title, abstract and keywords. The CO needs this information in order to assign suitable reviewers to each paper. In addition, the presence or absence of the author(s)' name(s) among the characteristics of the μ-token depends on the CO's setting of the reviewing mode, either single-blinded or double-blinded, respectively.

In the opposite case, when predicate $W_{12,19}$ is "true", the submitted paper does not comply with the technical requirements and is not accepted by the OSS. Then, the σ-token from place L_{12} splits in two identical copies and transfers to places L_{17} and L_{19}. The π-token from place L_{15} also splits in two identical copies and transfers to places L_{17} and L_{19}. In place L_{19}, the σ-token and the π-token merge in a ε-token that represents an error report that is forwarded to the paper's author, giving the exact reason for the unsuccessful submission. The ε-token has the characteristic "paper identifier, paper author(s), list of technical requirements that have not been met". In place L_{17}, the σ-token and the π-token merge in a ε-token that represents an error report that is forwarded to the CO, in order to keep them aware of the attempts made by authors to submit their works to the conference, as well as the reasons for failure. The ε-token in place L_{17} has identical characteristics with the one that is generated in place L_{19}, the difference being in the addressee of the report. In a bit more sophisticated model, these tokens can play a rather important role for turning the OSS into a intelligent system that analyses the error reports and seeks for common failure patterns and possible explanations. Thus, it may proactively offer the CO corrective measures, which would be especially helpful when done in a timely manner before the submission deadline.

Finally, when the CO (having already been notified of the successful submission(s)) assigns the paper(s) collected in place L_{20} to (two or more) reviewers, predicate $W_{20,18}$ becomes "true" and leads to the transfer of the π-tokens with the assigned paper(s) from place L_{20} to place L_{18}. The π-tokens obtain in L_{18} the characteristics "identifier, contents of the paper". Again, the

author(s)' name(s) are to be included as a token characteristics or not, depending on the reviewing mode.

Transition Z_6 has the following form:

$$Z_6 = \langle \{L_9, L_{18}, L_{22}\}, \{L_{21}, L_{22}\}, M_6, \wedge(L_9, L_{18}) \rangle$$

where

$$M_6 = \begin{array}{c|cc} & L_{21} & L_{22} \\ \hline L_9 & false & true \\ L_{18} & false & true \\ L_{22} & W_{22,21} & false \end{array},$$

and the predicate in the index matrix M_6 has the following meaning: $W_{22,21}$ = "all of the reviewers of the paper have provided their opinions about it".

In place L_{18} stays the π-token with the paper, identified with the numerical identifier obtained when registering it in the OSS. In place L_9 stay the ρ-tokens, representing all of the reviewers that were designated by the conference committee to review the respective paper. For each of these ρ-tokens, the ρ-token and the π-token transfer to place L_{22}, where they merge into a new o-token that obtains the characteristic "paper identifier, reviewer #*i*, opinion". The first o-token that enters place L_{22}, i.e. the first opinion received, remains there until all designated reviewers for that paper submit their reviews, namely, all respective o-tokens are generated in that place. Every time when a new o-token generates, it merges with the current one, adding its characteristics to the already existing ones.

When all reviewers have submitted their opinions about the reviewed paper, the finally accumulated o-token is sent from place L_{22} to L_{21}, without changing its characteristic. From there, as we remember from the definition of transition Z_2, the token unconditionally transfers to place L_{11}, representing the CO.

4 Conclusion

The present paper offers a first sketch of a generalized net model of a conference online submission system. It naturally lacks a lot of the aspects of the overall process, but focuses on the interactions between an online submission system provider, the conference organizer and the end users.

In future, the model can be further elaborated with a more detailed looks into different directions. As it was noted above, a fruitful direction of research is adding some elements of intelligent decision making, that may require even data mining approaches for recognition of common patterns of problems.

Other directions of research can focus on the process of reviewing, into the process of decision making of the most appropriate reviewers, into the process of selection of criteria for approval, etc. The relations between the conference organizers and the online submission system providers can be also elaborated both during the active usage of the system, as well as *post factum*, using the results of the model, for the purpose of improving the collaboration and communication between the parties that take part in the process.

Acknowledgment

This work is supported by the Bulgarian National Science Fund, Grant DID-02-29 "Modelling of processes with fixed development rules".

References

[1] Alexieva, J., E. Choy, E. Koycheva. Review and bibliography on generalized nets theory and applications. –In: *A Survey of Generalized Nets* (E. Choy, M. Krawczak, A. Shannon and E. Szmidt, Eds.), Raffles KvB Monograph No 10, 2007, 207-301

[2] Atanassov, K. *Generalized nets*, World Scientific, Singapore, 1991.

[3] Atanassov, K. *On Generalized Nets Theory*, "Prof. M. Drinov" Academic Publ. House, Sofia, 2007.

[4] EDAS: Editor's Assistant. `http://edas.info/doc/`.