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GENERALIZED NETS HAVING PLACES WITH LIMITED GLOBAL CAPACITIES

Krassimir T. Atanassov[1], Stefan Dantchev[2]

[1] CLBME – Bulgarian Academy of Sciences, Acad. G. Bonchev Str., Bl. 105, Sofia-1113, Bulgaria
e-mail: krat@bas.bg

[2] Dept. of Computer Science, University of Durham, Science Labs, South Road, Durham, DH1 3LE, UK
e-mail: s.s.dantchev@dur.ac.uk

A variety of different types of Generalized Net (GN) extensions have been defined and each of them has been proven to be a conservative extension of the ordinary GNs (see e.g. [1,2]).

In this note, we introduce yet another extension and prove that it is a conservative one.

We use the following notations throughout:

• $\mathcal{N} = \{0, 1, 2, \ldots\} \cup \{\infty\}$;

• $pr_i X$ is the i-th projection of the n-dimensional set, where $n \in \mathcal{N}, n \geq 1$, and $1 \leq i \leq n$. More generally, for a given n-dimensional set X $(n \geq 2)$

$$pr_{i_1,i_2,\ldots i_k} X = \prod_{j=1}^{k} pr_{i_j} X$$

where $1 \leq i_1 < i_2 < \ldots < i_k \leq n$.

• $card(X)$ is the cardinality of set X.

As for the GN-specific notation, we refer the reader to [1,2].

The formal definition of the new type of extension coincide with this of the ordinary GN. Every transition is described by a seven-tuple (see Fig. 1):

$$Z = \langle L', L'', t_1, t_2, r, M, \Box \rangle,$$

where:

(a) L' and L'' are finite, non-empty sets of places (the transition's input and output places, respectively); for the transition in Fig. 1 these are

$$L' = \{l'_1, l'_2, \ldots, l'_m\}$$

and

$$L'' = \{l''_1, l''_2, \ldots, l''_n\};$$

(b) t_1 is the current time-moment of the transition's firing;

(c) t_2 is the current value of the duration of its active state;

(d) r is the transition's *condition* determining which tokens will transfer from the transition's inputs to its outputs. Parameter r has the form of an Index Matrix (IM, see [1,2]):

$$r = \begin{array}{c|c}
 & l''_1 \;\ldots\; l''_j \;\ldots\; l''_n \\
\hline
l'_1 & \\
\vdots & r_{i,j} \\
l'_i & (r_{i,j} \;\; - \text{ predicate}) \\
\vdots & (1 \le i \le m, 1 \le j \le n) \\
l'_m &
\end{array} \quad ;$$

where $r_{i,j}$ is the predicate which expresses the condition for transfer from the i-th input place to the j-th output place with the obvious meaning: whenever $r_{i,j}$ has truth-value "*true*", a token from the i-th input place can be transferred to the j-th output place; otherwise, such a transfer is not allowed;

(e) M is an IM of the capacities of transition's arcs:

$$M = \begin{array}{c|c}
 & l''_1 \;\ldots\; l''_j \;\ldots\; l''_n \\
\hline
l'_1 & \\
\vdots & m_{i,j} \\
l'_i & (m_{i,j} \ge 0 - \text{ natural number or } \infty) \\
\vdots & (1 \le i \le m, 1 \le j \le n) \\
l'_m &
\end{array} \quad ;$$

(f) $\square$ is called transition type and it is an object having a form similar to a Boolean expression. It may contain as variables the symbols that serve as labels for transition's input places, and it is an expression constructed of variables and the Boolean connectives $\wedge$ and $\vee$ determining the following conditions:

$\wedge(l_{i_1}, l_{i_2}, \ldots, l_{i_u})$ – every place $l_{i_1}, l_{i_2}, \ldots, l_{i_u}$ must contain at least one token,

$\vee(l_{i_1}, l_{i_2}, \ldots, l_{i_u})$ – there must be at least one token in the set of places $l_{i_1}, l_{i_2}, \ldots, l_{i_u}$, where $\{l_{i_1}, l_{i_2}, \ldots, l_{i_u}\} \subset L'$.