Parametrisation of CSA-nets

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The modelling approach proposed in this paper has its origin in the structured occurrence nets [1] that are a Petri net-based model for the representation of the execution behavior of complex evolving systems. They are an extension of occurrence nets which represent the causality and concurrency information relating to a single system execution. In general, a structured occurrence net consists of several occurrence nets linked through different types of formal relationships.

A particular formal model we are using in this paper are the communication structured occurrence nets (CSA-nets), which are generalisations of communication structured occurrence nets (a subclass of structured occurrence nets [1]), where individual acyclic nets are linked by buffer places capable of modelling both asynchronous and synchronous communication between different subsystems.

Master buffer places

A CSA-net consists of sets of acyclic nets that communicate with each other through a set of buffer places. This can generate an excessive number of buffer places which makes the model hard to visualise and analyse, especially for large CSA-nets. Therefore, in [2] we proposed to use master buffer places (MBPs), which introduce conciseness to CSA-nets by collapsing/folding (some of) the original buffer places into master buffer places. This allows buffer places to represent more than one token at a time to avoid having a large number of distinct buffer places. Additionally, it may allow the component acyclic nets to communicate through a unique buffer place. Inside a master buffer place, there is a set of tokens represented by unique colours. A specific token appears in the master buffer place without conflicting with other tokens in each execution since the net is colour-safe due to the fact that the original CSA-net was safe. This enhances CSA-net visualisation contributing to a more readable and understandable model.

Parameterised CSA-nets

We will apply the concept of folding to other components of CSA-nets while preserving the overall behaviour. The idea is to determine the set of the components that are behaving identically, and then representing them as a single substructure. This uses typed parameters to achieve the desired effect through passing coloured tokens to parameterised transition. Parameterisation is used to change system outputs by changing its input parameters (in other words, different parameters can be used to define a set of different outputs). The main advantage of parameterisations is that the

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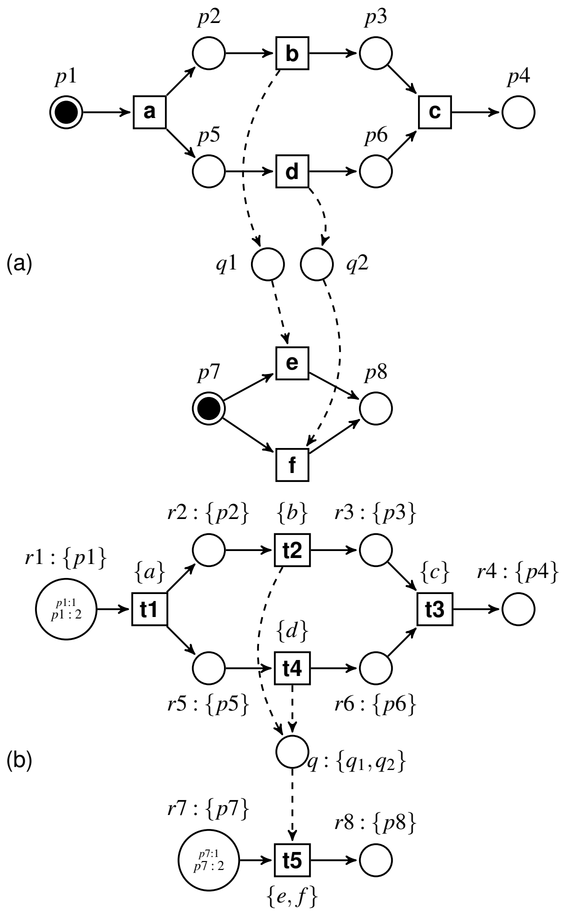

Figure 1: A CSA-net (a); and the result of introducing master buffer place and folding (b).

structure of a system model does not need to be re-built each time it is run. Such an approach will allow the reuse of the model multiple times and increase comprehension and make larger systems under investigation easier to handle. Figure 1 illustrates the transition from the original CSA-nets to their parameterised versions.

References

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[2] M. Alahmadi, Master channel places for communication structured acyclic nets, in: M. Köhler-Bussmeier, E. Kindler, H. Rölke (Eds.), Proceedings of the International Workshop on Petri Nets and Software Engineering 2021, volume 2907 of *CEUR Workshop Proceedings*, CEUR-WS.org, 2021, pp. 233–240.