PetShop: A Tool for the Behavioral Specification of Distributed Component-Based Systems.

Rémi Bastide

LIIHS-IRIT, Université Toulouse 1, Place Anatole France,
F-31042 Toulouse CEDEX, France

Remi.Bastide@irit.fr

ABSTRACT

PetShop is a CASE tool dedicated to the formal behavioral specification of distributed component-based systems. The tool uses high-level Petri nets as its specification language, and integrates seamlessly in a CORBA distributed environment, allowing for direct interpretation of specification models.

Keywords

Distributed systems, behavioral specification, CORBA, high-level Petri nets, Components.

1. INTRODUCTION

PetShop (short for Petri nets workshop) is a CASE tool aimed at providing a formal notation suitable to specify the behavior of component-based distributed systems. This tool supports our approach to formal specification which consists in the following:

- Define a component model. We have chosen a component model strongly inspired by the CORBA Component Model (CCM), yet simpler and more precise. In particular, we focus on a behavioral semantics of component activity, and leave out many practical aspects of CCM (such as deployment) that are fundamental in an industrial setting, but mainly resort to "plumbing" and convey little theoretical interest.
- Propose a notation to formally specify the internal behavior of a software component. Our formal approach is based on High-Level Petri nets [3], and builds upon our previous work on formal specification of CORBA objects [1]. It may be considered as an extension of this previous, object-oriented work to component-oriented programming. Its Petri net foundations makes it particularly well suited to the modeling of concurrent, distributed or event-driven systems [2], and amenable to formal verification.
- Define a mapping from the constructs of the component models (e.g. facets, receptacles, event sources and sinks) to the constructs of our Petri-net based behavioral formalism (e.g. places, transitions, etc.).
- Provide a formal definition of inter-components communication primitives, (invocation of methods, event-based communication and access to properties). This definition is also given in terms of Petri nets.
- Provide a denotational semantics of an assembly of components, in order to define the behavior of such a system in terms of the individual behavior of each component and of the formal definition of inter-component communication primitives.

PetShop allows specifying the behavior of a component in terms of high-level Petri nets. The tool is both and editor and an interpreter for the formal specification: Each class under design is associated to a running CORBA servant, which can be invoked by any other CORBA object. The tool also acts as a high-level debugger for the specification, which allows inspecting the various elements of the specification at run-time. Moreover, the tool integrates several Petri net analysis algorithms, which allows checking the specification for important properties, such as invariants.

The expected benefits of such an approach are threefold:

- Offer a convenient notation for describing the internal behavior of concurrent and distributed components,
- Provide a formal, unambiguous semantics of component features such as event multicast or properties, especially inter-components communication,
- And, with the previous two being necessary conditions, offer some means to reason about assemblies of components designed with this approach, in particular to mathematically verify properties on them.

2. REFERENCES

1. Bastide, Rémi, Palanque, Philippe, Sy, Ousmane, Le, Duc-Hoa, and Navarre, David. "Petri-Net Based Behavioural Specification of CORBA Systems." *20th International Conference on Applications and Theory of Petri Nets, ICATPN'99* , Williamsburg, VA, USA. Susanna Donatelli, and Jetty Kleijn, Volume editors. Lecture Notes in Computer Science, no. 1639. Springer (1999) 66-85 .

2. Bastide, Rémi, Sy, Ousmane, Navarre, David, and Palanque, Philippe. "A Formal Specification of the CORBA Event Service." *IFIP TC6/WG6.1 4th International Conference on Formal Methods for Open Object-Based Distributed Systems (FMOODS 2000)*, Stanford university, California, USA. Scott F. Smith, and Carolyn F. Talcott, editors . Kluwer (2000) 371-96.

3. Jensen, Kurt. *Coloured Petri Nets. Basic Concepts, Analysis Methods and Practical Use*. 2nd edition ed., Vol. 2 Springer-Verlag (1996).