Asynchronous Programming in the Abstract Behavioural Specification Language

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Epilogue

In the following, we present a few major research directions concerning the new modeling and analysis techniques introduced in this thesis.

Regarding the preferential attachment case study discussed in parts II and III, the proposed models are implemented in the ABS with the Haskell backend, and [10–12] that represent the performance results for the generation of the social networks. A further challenge is to investigate the practical limits of the network size (i.e., the number of nodes in the resulting network) that can be generated in the parallel and distributed implementations. To this aim, the models need to be further investigated for improvements in both time and memory complexities, that possibly enable generation of larger networks. Also the Haskell backend can be further improved such that ABS leverages efficient underlying Haskell data structures.

The ABS with Haskell backend supports real-time programming techniques which allows for specifying deadlines with method invocations. This provides an interesting basis to extend ABS with real-time data streaming which may, as an example, involve timeouts on read operations. Another interesting direction is to extend the various formal analysis techniques (e.g., deadlock detection, general functional analysis based on method contracts) currently supported by the ABS to the ABS model of streaming data discussed in part III.

A major new research direction, in line with the deadlock analysis technique introduced in part IV, is to extend the predicate abstraction technique to the full ABS language. This requires the development of abstraction techniques which capture in a finite model an unbounded number of actors and their interactions.

This line of research is related to the development of a theory for proving correctness of ABS models. An open problem in this area is a proof theory for an actor-based language like ABS which integrates asynchronous method invocations, futures and cooperative scheduling, which is both sound and complete. Further proof-theoretical challenges concern the asynchronous programming techniques of data streaming and multi-threaded actors introduced in this thesis.

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