Propositional Dynamic Logic with Converse and Repeat for Message-Passing Systems

Roy Menicke, TU Ilmenau

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The model checking problem for propositional dynamic logic (PDL) over message sequence charts (MSCs) and communicating finite state machines (CFMs) asks, given a channel bound B, a PDL formula F and a CFM A, whether every existentially B-bounded MSC M accepted by A satisfies F. Recently, it was shown that this problem is PSPACE-complete. In the present work, we consider CRPDL over MSCs which is PDL equipped with the operators converse and repeat. The former enables one to walk back and forth within an MSC using a single path expression whereas the latter allows to express that a path expression can be repeated infinitely often. To solve the model checking problem for this logic, we define global message sequence chart automata (gMSCAs) which are multi-way alternating parity automata walking on MSCs. By exploiting a new concept called concatenation states, we are able to inductively construct, for every CRPDL formula F, a finite set of gMSCAs G such that the set of models of F equals the union of the languages of the gMSCAs from G. As a result, we obtain that the model checking problem for CRPDL and CFMs is still in PSPACE.