

XmCTL: EXTENDING TEMPORAL LOGIC TO FACILITATE FORMAL VERIFICATION OF X-MACHINE MODELS

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Abstract

Model checking is a formal verification technique which determines whether certain properties are satisfied by a system model. Prerequisites for applying model checking are: (i) to view the agent as a Finite State Machine, and (ii) to be able to express the properties in a powerful specification formalism, such as Temporal Logic. Finite State Machines are too simple to capture the modelling needs of dynamic systems (e.g. agents) that normally require non-trivial data structures as well as complex control over these data structures and over the states in which these systems can exist. X-Machines is a formal method that satisfies these requirements by introducing memory structure into finite state machines as well as computable functions between states of a model. With existing logics it is obscure how one can describe properties that refer to the memory data structure of a X-machine model. Thus, a new approach to model checking of such systems should be introduced. This paper defines the syntax and the semantics of a new logic, namely XmCTL, which extends temporal logic with memory quantifiers, thus facilitating model checking targeted to X-machine models. To demonstrate the feasibility of formal verification of X-machine models, XmCTL model checking is defined and new algorithms are proposed. The use of XmCTL and the importance of verification in system development are demonstrated through a simple example borrowed from the domain of intelligent agents.