

# Adaptation is a Game

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## ABSTRACT

Software systems operating in unpredictable environments must be *self-adaptive*. Unfortunately, there is no agreed foundational model for adaptation. Already in 1963 Lofti Zadeh claimed that “*it is very difficult—perhaps impossible—to find a way of characterizing in concrete terms the large variety of ways in which adaptive behavior can be realized*”. His pessimism was due to the inherent difficulty of subsuming both the *external* manifestations of adaptive systems (*black-box* adaptation) and the *internal* mechanisms that realize adaptation (*white-box* adaptation) in a coherent view.

Generally speaking, a program is considered to be adaptive if it modifies its own behavior in response to changes in its operating environment. According to the traditional view, a program is made of *control* (i.e. algorithms) and *data*. A change in the behavior implies a change in the data. The identification of suitable *control data* leads to an unambiguous definition of adaptation: the run-time modification of such data [1].

The above view can be elegantly formalized in variants of game models for open systems such as Interface Automata [3] enriched with formal counterparts of control data [2]. We argue that such formalization may help to reconcile black- and white-box approaches to adaptation, and may enable the use of Interface Automata both as a component-based design framework and as a verification framework for adaptive systems. For instance, model checking techniques for game models can be used to decide to which extent a system is able to adapt in order to satisfy its requirements despite of changes in the environment.

## BODY

*Control data variants of game models such as Interface Automata are suitable for the design and analysis of self-adaptive systems.*

## REFERENCES

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