ABSTRACT

The aim of this research is to describe the formal protocol conversion as a solution to the heterogeneous internetworking problem. Communicating Finite State Machines (CFSMs) with First-In-First-Out (FIFO) queues are used to model the protocols as well as the converter. The main work, devoted exclusively to the conversion of protocols, includes a small but representative review of the broad range of research, currently going on in this area, and two novel approaches to produce a finite state converter R between the sender CFSM A_0 of protocol $A=[A_0,A_1]$ and the receiver CFSM B_1 of protocol $B=[B_0,B_1]$. To minimize the design complexity of a converter between two large protocols, a reduction of state transition graph technique is introduced to enhance the CFSM based protocol conversion algorithms. In this technique, the protocol CFSMs are first reduced with respect to the given significant operation set, and a reduced converter R' is produced from them. Next, the reduced converter R' is expanded to obtain the complete converter R. The improvement is shown to be achieved over the famous bottom up algorithm proposed by Okumura [178]. Suggestions are also made regarding the application of the reduction technique to other bottom up algorithms available in the literature. However, keeping such conversion instances in mind where Okumura's algorithm fails to produce a workable converter, another fast bottom up algorithm, called trace matching algorithm, for protocol conversion has been developed. It is based on a given matching relation between the trace (sequence of events) sets of protocol CFSMs A_1 and B_0. The algorithm involves a test for the legality of states in terms of related traces from the two protocols, while forming the cartesian cross product of the protocol CFSMs. Several example conversions demonstrate the applicability of both the algorithms. Moreover, to validate the resulting heterogeneous protocol systems $H=[A_0,R,B_1]$, a novel reduced reachability analysis is also presented at the end.