

Automatic Test Purpose Generation based on Formal Grammar Representation of Communication Protocols

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Formal grammars are a new, simple and efficient representation of communication protocols. The great advantage of using formal grammars is a wide scale of tools and algorithms for generating and handling them. In this paper a method will be introduced for generating test purposes from a formal grammar protocol specification. Additionally we show that the usual tools for handling formal grammars are suitable for generating test purposes automatically.

The behavioral equivalence between the specification of the protocol and the implementation is theoretically possible, but the practical implementation is a very hard problem. In the case of real systems and protocols, the state space can be extremely big or infinite so testing of all state transitions is impossible. Thus, instead of the behavioral equivalence a set of test cases are used to test the most important aspects and behaviors of protocols. Usually test cases are based on test purposes. A test purpose declares an important feature of the protocol, but it is usually informal, so there can be contradiction between the test purposes and the specification. Furthermore, if a new version of the protocol appears, the upgrading process of test purposes is very complex and test cases can not be derived automatically from the formal protocol specification.

To cope with these problems, several proposals were made to express test purposes formally. Test purposes usually contains observable events such as abstract service primitive calls or receiving and sending protocol data units. Message Sequence Chart is adequate language for expressing these events, so it is suitable to express the formal test purposes. But how can Message Sequence Chart diagrams be generated from formal grammars? Test purposes express a relevant behavior of the protocol. This definition is adequate in case of informal test purposes, but does not satisfy the requirements in case of formal ones. In this work the formal test cases are defined as syntactically valid sentences in the formal grammar that representing the communication protocol. These sentences can be derived from the formal grammar specification by the help of formal grammar parsers. The result of this definition that the usual tools for parsing formal grammars can be used for generating test purposes automatically and if the protocol specification is changed, the upgrade process of test purposes can be made automatically.

In the second part of the paper an example will illustrate, the formal grammar specification of a simple protocol. Based on the definition of formal test purposes all the syntactically correct sentences will be generated automatically and finally, a Bison parser will be used to translate these sentences to Message Sequence Chart diagrams.