Algebraic Aspects of the Mapping between Abstract Syntax Notation One and CORBA IDL

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With the advent of network computing, a distributed program computation is a product of computations of single programs running on heterogeneous platforms, written in different programming languages, and exchanging messages. In this context, the need of a uniform abstract notation, machine and platform independent, to be used for the message exchange between communicating software entities, has given birth to ASN.1. This notation is a data type specification beyond the scope of any programming language. In the same context, the need of an environment to program distributed applications at a high level of abstraction with respect to communication protocols and operating systems architectures has led to the emergence of the Common Object Request Broker Architecture (CORBA). The core of CORBA is represented by the Interface Description Language (IDL). IDL is used to define objects which can be accessed via the Object Request Broker (ORB). Similar to the case of ASN.1, IDL has its own mechanisms to build complex data types, which can be mapped partially to those of ASN.1. Such a mapping makes the subject of this paper. It allows building applications that bridge the field of ASN.1 based communication protocols and that of CORBA based distributed applications.

In the present work a high level formal specification in Z of both the ASN.1 and IDL syntax notations is given. Syntactic aspects of the two notations are expressed in Z using free type definitions, while for the semantic features of the two notations invariants are used. This framework is used for analyzing the ambiguities of ASN.1 definitions as well as for finding the extent to which the mapping between the two notations is possible. The target of the present research is to formulate the ASN.1 - IDL translation rules, such that the diagram (1) below commutes and to set the mechanisms for gateways between CORBA based network management applications and agents using SNMP or CMIP; both network management protocols relying on the ASN.1 notation. The mapping is analyzed both at a high level, that of the abstract syntax as well as at a low level, the one of the transfer syntax. So far these aspects have been investigated for small isomorphic subsets of ASN.1 and IDL. The Z notation and the Z-EVES theorem prover have been successfully used to prove that the diagram (1) commutes.

$$\begin{array}{ccc} ASNType & \xrightarrow{RelationalMap} & IDLType \\ {\scriptstyle ASNImageOfType}\downarrow & & \downarrow{\scriptstyle IDLImageOfType} \\ ASNValue & \longrightarrow & IDLValue \end{array} \qquad (1)$$

J. Wing, J. Woodcock, J. Davies (Eds.): FM'99, Vol. II, LNCS 1709, pp. 1863–1863, 1999.