Experiences with CORBA interceptors

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Abstract

CORBA offers a limited form of behavioral reflection through the so-called *interceptors*. The OMG is improving the current interceptor specification, i.e. make it less ambiguous and thus more portable, and extending it, i.e. by defining new interception points, through the Portable Interceptor RFP. In this paper we shortly describe our experiences with the current (CORBA 2.2) interceptors, and with prototypes which aim to fulfill the new interception points defined in the submission for the Portable Interceptor RFP. Based on these experiences we discuss limitations and problems of interceptors in CORBA. The main conclusions we draw are that besides being underspecified and thus not portable, interceptors in CORBA have very limited capabilities for adaptation, and are mainly suitable for inspection. Another problem is that the current and new interceptor specifications do not support a clean composition of interceptors.

Keywords: CORBA, portable interceptors, QoS management, Open Communication Interface

Introduction

Interceptors enable third-parties to extend a CORBA implementation with additional functionality in an ORB independent manner. We've investigated the use of CORBA interceptors for the QoS Management of CORBA systems.

QoS management requires a certain amount of openness of the middleware, and we consider reflection the most promising approach for this [GordonCoulson98]. In CORBA the interceptor mechanism is closest to what one can get to reflection.

The Portable Object Adaptor also offers a limited form of reflection, which we also used, but is of less interest and therefore not discussed further in his paper.

Although originally designed to be a black box, since CORBA 2.2 the OMG has opened the ORB a bit by allowing the interception of messages at certain defined places within an ORB. CORBA interceptors are standardized (as optional) and are mainly meant to allow an ORB independent implementation of certain services like the Security service. The submissions for the Portable Interceptor RFP [PortIntSubmissions] define two new interception points, the *network interceptors* which allow the usage of different transport protocols, and the *object level interceptors* which allow the interception of lifecycle events. Based on these submissions we defined our own interceptors at the different levels mentioned in the RFP. These levels are the already existing request and message level interceptors, and the above mentioned object and network level interceptors. Our object level interceptors can intercept the lifecycle of proxy-objects at the client side, and the lifecycle of objects at the server side. As network level interceptors we used the Open Communication Interface (OCI) [FischbeckKath99].

The object level and request level interceptors were used in a management architecture for the management of CORBA based systems [Wegdam00]. The OCI interface we used to implement a QoS framework that uses specialized protocols [Halteren99]. Both applications have in common that they require a certain amount of monitoring, and depending on the results of this monitoring

they have to control the parameters, configuration or composition of the ORB.

Experiences

This section describes our experiences with the usage of interceptors in CORBA to implement reflection. First of all, the current specification is very much underspecified, and is only implemented by a limited subset of the vendors, although some vendors have similar proprietary mechanisms (for example filters in Orbix and Visigenic). A second observation is that the performance penalties can be quite extensive, and are unacceptable in some circumstances. As an example of this overhead, we did some tests with JacORB (http://www.inf.fu-berlin.de/~brose/jacorb/) which indicated a typical 300 ms overhead for a request.

The request and message level interceptors mainly offer behavioral inspection, and lack sufficient capabilities for adaptation. An example of this is that it is not possible to change the target object for a request using a request level interceptor. The object level interceptor offers limited possibilities to inspect and adapt some structural aspects. The OCI implementation of the network level interceptor point offers capabilities to adapt the behavior (i.e. change the used protocol), but not during run-time, which is often required.

A problem yet to be solved is how to arrange the composition of several interceptors, i.e. the invocation order. Interceptors are developed independently, and the composition of these interceptors can lead to feature interaction problems. We used a straight-forward AND composition, as will probably be standardized with the Portable Interceptors RFP, in which the order is controlled by the application object. In our opinion a more advanced mechanism is required to control the order, and this mechanism should be located in the meta-layer.

Summary

The CORBA architecture was designed with a black box in mind, but the OMG has started to open up this box. CORBA Interceptors is the main attempt for this. The new CORBA Portable Interceptors will, if standardized, offer some limited forms of environment and structural reflection, and will be portable between ORB's. They however will not be very suitable for more ambitious forms of reflection, and will not solve the composability problem.

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