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Managing CORBA based Agent Through an OSI/TMN System

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Abstract

The integration of heterogeneous networks and systems is one of the more urgent requirements expressed by networks and computer users. ISO and ITU-T normalisation bodies have contributed in a significant manner to the definition of a global management framework called TMN (Telecommunication Management Network). TMN is an agreed framework that permitted to a number of public and private network operators to build their management system. However, these existing systems are confronted to the heterogeneity of emerging technologies. In fact, new equipment is built with specific management interfaces, which are not conforming, to the TMN one. The heterogeneity considered in this paper is the one that emerges from the OMG (Object Management Group) CORBA (Common Object Request Broker Architecture). In fact, a lot of CORBA based systems are emerging in the field of management. In this context, telecommunication operators are willing in the short term to use their existing management systems to control them in a uniform way. The aim of this paper is to propose solutions to these problems through the use of Q Adapter that permits to integrate CORBA based equipment into the global management framework based on TMN.

Keywords

Management, CORBA, OSI, Adaptation, Object, Protocol, Service

1 - INTRODUCTION

Management has become a major topic in computers and telecommunications world and important standardisation activities are ongoing in this area. A vertical integration of management of network and computer systems is one of the actual network and system's user requirements. Within the computing industry, network management as well as system management often uses private management systems. Significant effort is required to bridge these heterogeneous management standards. Problem of systems and networks management heterogeneity resulting from differences in models, services and protocols requires a global network management to enable an end-to-end management solution. Two approaches emerged to resolve the problem of interoperation of heterogeneous management systems: the first one is a short term solution adopted by network and system constructors and consists on the integration of other management systems throw specific integrators. A second solution that is middle and long term one is proposed by standard organisms such like ISO and ITU-T. Theses organisation have defined interoperability and co-operation standards and recommendations that should be adopted by the entire network operators, constructors.

The Telecommunication Management Network (TMN) standard offers architecture to comply with heterogeneous underlying communication equipment and software by harmonising and unifying the interface between the various exchange types and the operation system. CORBA is an object oriented open distributed processing platform emerging in computer and network systems market and being adopted by constructors in order to develop network equipment

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management interfaces.

This new equipment has introduced a new level of heterogeneity which operators would like to resolve in a cost-effective manner. In fact, the actual network operator's requirement is to integrate in a short term this equipment into the existing TMN based management systems. In fact, even if the probably middle term or long term TMN systems will be based completely on CORBA technology, the network operator will not migrate immediately to this technological option. The intermediate solution consists to interface the non standard network equipment with the TMN using proxy mechanisms. In the TMN architecture, It is a matter of Q adapter to be in charge of levelling, in term of protocol and information model, equipment, which do not have native Q interface.

The contribution presented in this paper is a investigation on how to design and implement Q adaptation functions (QAF) to be used in order to integrate network elements that support CORBA/IDL (Interface Description Language) based management functions into a TMN. The followed approach is the offer a generic environment, which assist and automate the production of a CORBA to TMN Q Adapter.

The two following sections introduce the standard management approach and the CORBA technology.

2 - INTEGRATED NETWORK MANAGEMENT

OSI management Concepts

The ISO work gives the way to manage communication between open systems and not the detailed network management system. It proposes a framework in which management systems architecture has to integrate without detailing internal architecture and organisation. The ISO/CCITT community defined the Common Management Information Protocol (CMIP) and related SMI documents [ISO10165-1/4]. The world of telecommunications and computer vendors, represented by organisations such as the Network Management Forum (NMF) have based their integrated management model on the ISO/CCITT management model using CMIP and the ISO/CCITT SMI.

ITU-T TMN Architecture

The M3010 recommendation from ITU-T presents the general principles for planning, operating and maintaining a Telecommunications Management Network (TMN). The basic goal is to provide an organised network structure to achieve the interconnection of the various types of management operations systems and telecommunications equipment using an agreed architecture with standardised protocols and interfaces. This architecture defines the building blocks which constitute the functionality of the TMN, namely to transport and process information related to the management of telecommunications networks.

As the solution of standard will be effective only in a middle indeed a long term, an intermediate solution is proposed by the TMN in order to manage vendor specific devices and equipment through the use of Q Adaptation functions.

CORBA Architecture

CORBA (Common Object Request Broker Architecture) is an emerging standard from OMG (Object Management Group). This recommendation follows in a pragmatic way the work undertaken by the ISO/ODP (Open Distributed Processing) group. CORBA technology aims to provide an open object distributed environment to support all distributed applications among other things OSI/TMN management systems. CORBA is an object oriented distributed system architecture where objects are described by their interfaces including attributes and operations. A CORBA object playing server role may be accessed transparently by any other CORBA object playing thus client role. The CORBA nucleus called ORB (Object request Broker) is an object oriented transparent RPC-like mechanism used as an intermediate layer between clients and servers objects. The interfaces between clients and ORB called stubs and the interfaces between ORB and servers called skeleton are specified with IDL (Interface Description Language).

3 – CORBA TO OSI ADAPTATION

The problem of interoperability between CORBA and OSI Management is being addressed by Consortia such like X/Open and NMF [XOJIMD] [Souk95]. The results of this work permit the definition of interface translation rules from GDMO/ASN.1 to IDL. Translation rules that allows OSI objects to be viewed by CORBA managers for the purpose of management.

Our issues in this work are to realise the reverse approach based on the assumption presented in the introduction. Our

objective is to specify the CQA (CORBA Q Adapter). The CQA is the generic CMIP/S to CORBA proxy that permit to interface CORBA management based systems to a TMN. Both the run-time and compile-time aspects of *automating interoperability* between CORBA IDL-based objects and OSI CMIP/S based managers are treated.

General Interaction Schema OSI To CORBA : In order to enable OSI manager to manipulate CORBA objects, we need to develop a gateway placed at the boundary between OSI and CORBA domain, which is responsible for the translation of requests, responses and information in an asynchronous way between the two domains. The CQA application gateway performs the role of an OSI agent at the upper layer and the role of a CORBA client/manager at the lower one. It uses the facilities provided by the OSI Generic Management System to support all the functionality's expected from an OSI agent at the boundary. The mapping services are provided by specialised objects inside the generic management system as well as by CORBA API functionality supported at the back-end. The functional architecture of the CQA application gateway is illustrated bellow.

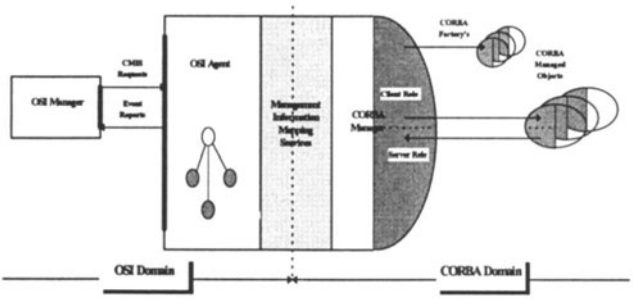

Figure 1. CQA Gateway Functional Architecture

An OSI manager has an abstract view of the global resources of the network through the management information base viewed by the agent. It manipulates the managed objects using CMIS services and CMIP protocol. The managed objects represent local object as well as CORBA resources. In fact, the CQA enables OSI manager to manage CORBA objects like if they were GDMO objects and then perform all the management services allowed by CMIS and thus independently of the specific CORBA object definition

CQA Information Translation : The information model translation is the first step of the definition of the CQA. The IDL to GDMO/ASN.1 translator consists to translate IDL definition of the object model at the boundary of the CORBA object into its equivalent GDMO model that will be presented at the CQA OSI boundary.

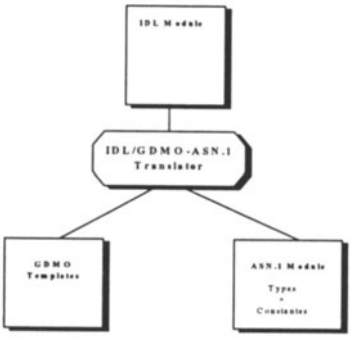

Figure 2. The Translation Process

CQA Service Translation: The interaction between OSI manager and managed CORBA objects can be resumed to the computation process issues by different services provided by CMIS and their translation inside the gateway. It consists on the translation of m-get, m-set, m-create, m-delete, m-action and finally the m-notify services.

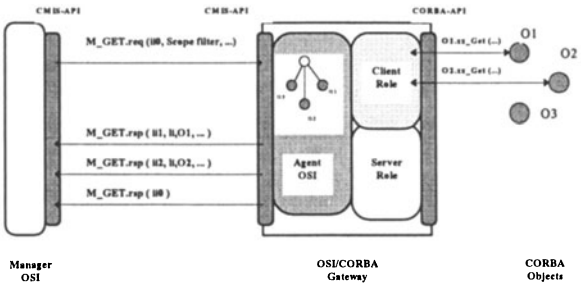

Figure 3. M-GET Service Translation Schema

CQA Gateway Implementation : The CQA gateway was developed using two technologies: ISODE/OSIMIS [Pavl92] and COOL-ORB. The gateway is a combine OSI agent functionality provided by OSIMIS and CORBA client functionality provided by the COOL-ORB platform and its CHIC IDL to C++ compiler. An IDL2GDMOASN.1 Compilation tool has thus been developed to generate automatically the GDMO and ASN.1 specifications of the CORBA Q-Adapter Management Information Base. The compiler accepts IDL specification as input and generates GDMO-ASN1 specification as an output. These specifications are then used by the OSIMIS ASN.1-GDMO compiler to product the OSIMIS agent generic code. IDL2GDMO-ASN.1 compiler generates also C++ specific methods implementing the interactions with the CORBA real objects. The C++ compiler is then used at the final stage to produce the gateway implementation using generic and specific code provided by OSIMIS, COOL-ORB and specific CQA libraries.

4 - CONCLUSION

We have proposed in this paper a design and a particular engineering implementation of a Q Adapter that will allow telecommunication operators to still use their existing TMN based management systems to manage the emerging CORBA based equipment. This solution will be efficient in the short term and the middle term and will permit an efficient migration to CORBA world even if the future management environment will be probably based on CORBA. Some aspects of the translation rise important complexity and constitute our following investigations. New support services defined by OMG will permit a better translation as some functionality can be directly realised by CORBA platform and then will reduce the complexity of the CQA.

5 - REFERENCES

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