X-type Interface for Management of Multi-domain, Multi-technology Networks

R.Díaz-Caldera, J.Serrat-Fernández
Universitat Politècnica de Catalunya
Dept. Signal Theory and Comms.
Campus Nord - UPC, Mòdul D4
08034- Barcelona (Spain)
{rdiaz, serrat}@tsc.upc.es

K.Berdekas, F.Karayannis
National Tech. University of Athens
Dept. Elect.Eng and Computer Science
Heroon Politechniou, 9
15773 Zographou - Athens (Greece)
{klearxos, fkara}telecom.ntua.gr

Keywords

X interface, co-operative management, ATM - SDH integrated management, TMN

Summary

The specification and implementation of Xcoop interfaces has received great attention in the last few years. In fact, the appropriate design of this system component is a key aspect for efficient and seamless co-operative management. In this context it is worth mentioning the EURESCOM P408 project and the standards of the European Telecommunication Standards Institute (ETSI) in Europe and the ITU-T and Telemanagement Forum related work worldwide.

The Xcoop specification presented in this paper, produced as part of the results of the project MISA [1] co-funded by the Commission of the European Union, is a step ahead in the evolution of this system interface. Distinguishing to preceding works, this one allows interactions between management systems independently to the underlying network technology ATM, SDH or hybrid. This is achieved by defining appropriate functionality and an information model, indeed, where the specific characteristics of ATM and SDH resources are abstracted and merged in common classes.

The information model contains a total of four specific managed resources which are defined in order to characterize the whole network of a Public Network Operator (PNO), the access points to this network, the connections across the network and the links between this and other PNOs. On the side of the functionality the Xcoop will support the following management functions allowing path provisioning (Configuration Management) and Fault Management.

- Update of the topology information of any other remote domain
- Get the potential connections that a given domain would be able to offer with specific QoS constraints
- Check the availability of the destination user to support connection requirements
- Reserve a connection with specific QoS, schedule and policy attributes

- Request the explicit activation of an already reserved connection
- Request the deactivation of an already active connection
- Request the release of a connection
- Change some characteristics of an already existing connection
- Notify events and alarms from any domain to any other one
- Request a recovery process and notify the result of a recovery process.

The Xcoop has been implemented in two commercial TMN platforms, namely the IBM TMN platform and the HP OpenView platform. The implementation in both cases conforms to the specifications of the Ensembles and information model that have been made public at [1].

On the IBM platform most Xcoop Manager and Agent sub-component is incorporated into a single multi-threaded operating-system process, focusing on object-oriented MIB techniques rather than protocols or state machines. Implementation object skeletons (C++ classes) are automatically derived from the X.700 compliant Information Model specifications and merged with code extensions (callbacks) which capture the semantics associated with the corresponding real world resources. Xcoop functionality is invoked upon receiving a CMIP Action or upon receiving a CMIP Notification. Parsing of the CMIP attributes string is done inside the callback, performing all necessary checking on syntax and semantics.

On the HP side, The Xcoop Agent and Xcoop Manager were developed with the HP OpenView MOT development environment. Stub components are generated automatically by the tool and they are customized by programming manually the corresponding behaviours. The MIB is not implemented directly because the Xcoop is intended to be used with a management system having an external database where all the data needed by the agent can be stored. A dummy containment tree is kept in the agent platform in order to allow the issue of CMIS primitives on instances of this tree. No action is taken before the meaningful data are validated in the database. The links between the Xcoop components and the management system is done by means of a socket in a client/server mode.

Several tests have been carried out with samples of the above mentioned prototypes in a hybrid ATM/SDH network in Europe. As a result of these tests we can conclude that our approach to support the management of multi-domain and multi-technology networks is feasible and flexible because besides the fact that only ATM and SDH have been used, the concept can cope with other network technologies, and may support a variety of QoS and traffic constraints, complex scheduling formats, different routing algorithms, as well as alarm reporting and correlation and effective recovery functions.

References

[1] ACTS Project AC080, Management of Integrated ATM and SDH Networks (MISA). Xcoop Interface Ensembles. http://www.misa.ch/