Integration Architecture of Multi-Technology Management Systems

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1. Overview

This paper outlines some of the experiences gained during the ACTS project Prospect, with respect to achieving integrated end-to-end network management in a heterogeneous environment. The project as a whole is concerned with the different aspects of integrated service and network management in the emerging open and liberalised telecommunications service market. As a case study for the project, a scenario has been chosen with a wide variety of organisational roles, ranging from public network operators and private network owners, through independent value-added service providers and multimedia tele-service providers, to service integration providers and service consumers.

The project has investigated a wide range of methodologies and techniques, applied to the different phases of the project life cycle. These include ODP viewpoints for system analysis and design, Ordit and SMART-BPM for business process analysis, OMT/UML for specification and documentation, TMN and TINA-SA for system modelling, and Java and C++ on Windows NT, IBM AIX and Sun Solaris platforms for implementation.

2. Integration

End-to-end integrated network management is concerned with establishing interworking between systems that were not necessarily meant to interwork originally. If successful integration of systems based on different technologies, using different management interfaces and/or owned by independent organisations is to be achieved, the differences need to be alleviated in a well-defined manner. The heterogeneity evident in the form or detail level of management information that is visible on the boundary between the provider systems and the consumer systems within or outside the service providers domain of responsibility has to be structured and encapsulated. For the purpose of defining a generic integration architecture, we have found it useful to make a clear distinction between service

logic and adaptation functionality. Obviously, part of the challenge is to define a consistent model of the 'pure' service logic, reasonably independent of technological or other variations. To simplify this process, it can be useful to identify and separate the types of differences or domains of heterogeneity. In Prospect, three distinct domains of heterogeneity have been identified:

- administrative differences, caused by owners defining and enforcing their own policies, such as access control and accountability,
- technological differences, caused by differences in communications technologies, and
- (service) model differences, which are the result of deploying components for different purposes and applications. One of the results is that different components will offer different services to its users. Another result is that the same service may be offered by different components, in a way that is difficult to discover.

In order to alleviate these differences, a corresponding set of gateways (physical components or conceptual blocks of functionality) are defined: Administrative gateways, technology gateways and model gateways.

A tele-education scenario chosen for validation in Prospect includes various service and network management systems, including a tele-education service management system. The major application of the architecture principle is a CORBA-based VPN service management system, managing a public ATM network with CMIP-based management systems and private IP/ATM networks with SNMP-based management systems. A number of gateway implementations have been prototyped. As examples, a generic CORBA/CMIP gateway, a CORBA/SNMP gateway (both technology gateways) and a reusable implementation of the TINA Subscription Model (an administrative gateway) can be mentioned.

As a result of employing this strategy we have demonstrated, through trials approximating real-life conditions, successful end-to-end management of IP-over-ATM connections, using ATM switches from different vendors (Ericsson, DSC Communications and Fore Systems) and systems managed by different technologies (CORBA, CMIP and SNMP) in a scenario with multiple ownership domains. As an added benefit, we have found that with a proper separation of core service logic and adaptation functionality, the task of development is simplified to a large extent, while keeping the systems open for future additions.

3. Conclusions

The experience gained from developing the integrated network management system in Prospect shows that it is indeed possible to provide the types of network management integration required to enable end to end communications management across the domain boundaries of a heterogeneous network infrastructure. It also shows that CORBA is feasible for developing such systems at the service management layer, and that the application of CORBA does not violate any TMN architectural principles. Rather, CORBA is becoming a realistic TMN realisation technology.