Network fault management system

by Peet Badenhorst and Gerhard Olivier, Telkom

This article discusses the key design factors and implementation considerations of the Telkom network fault management system (NFMS).

Being able to view the health and status of a communications network is a key requirement in providing a world-class telecommunication service. Having a single, integrated, and centralised view of network faults is a distinct advantage in the overall process of network management and aids ultimately in providing a better service to the customer.

The following discussion will be focused on the collection and correlation phases of the project as being developed by Telkom Laboratories after Cisco and other contractors implemented the initial pilot.

The importance of network management is highlighted by the efforts of organisations like the Telecommunication Management Forum (TMF), International Telecommunications Union (ITU), and International Organisation for Standardisation (ISO), in developing models like new generation operations systems and software (NGOSS), telecommunication management network (TMN), and faults, configuration, accounting, performance, and security (FCAPS).

Putting a complete network fault management solution in place, that includes the collection and correlation of faults, cuts almost through all the layers of the TMN model. These are the network element layer (NEL), element management layer (EML), network management layer (NML), service management layer (SML), and the business management layer (BML) (see Fig. 1).

The NFMS can collect events from the NEL, EML or NML and can provide an SML-like view through additional optional modules.

NFMS architecture

The NFMS functional architecture consists of three layers: the collection layer, routing layer, and display layer. The collection layer is responsible for the collection of fault management events from the various network technologies. Both active and passive probes are used to translate technology-specific events into a common format for presentation to the centralised platform. Correlation and root-cause analysis are performed in the routing layer, bringing about significant event reduction. Event enrichment can be performed that enhances alarms to assist operators and dispatched technicians. The display layer is responsible for the presentation of the events to the operators and a video wall in the National Network Operations Centre (NNOC).

Telkom implementation

The Telkom laboratories were tasked to investigate, implement, and document interfacing to various technologies in the Telkom network fault management system. The criteria to evaluate suitable candidate technologies included added business value, cost, time to implement, manageability, scalability, reliability, existing equipment, network restrictions and human and material resource availability.

More than 60 different technologies used within the Telkom network were evaluated for integration during the past two years.

Once the events from the various technologies are collected onto a centralised platform, in-domain as well as cross-domain correlation serve to drastically reduce event volumes through automated root-cause analysis. On project completion, centralised management will bring about enhanced visibility, improved collaboration, automated trouble ticketing, effortless reporting, advanced data mining capabilities, service views, faster response times, proactive fault-finding, and the improved effectiveness of monitoring of environmental alarms to prevent loss of life and property (e.g. fire alarms).

The technologies investigated were hosted on multiple platforms, including various UNIXes, Microsoft Windows, and vendor specific embedded platforms (Siemens, Alcatel, Ericsson, Nicotra, Lucent, etc.). Database interfaces developed and evaluated included Oracle, Microsoft SQL, Sybase, ODBC, JDBC, Informix, and SQL Anywhere. Network protocols like CORBA, SNMP, TL1, FTP, SMTP, TCP/IP, Syslog, HPOV NNM6 and CMIP/Q3 were utilised or considered. Product certification provided the required knowledge for implementation. A broad skill-set of network fault management as well as UNIX, Database Structured Query Language (SQL), and network protocols aided the developers. Various custom developments were undertaken in Java, C/C++, and shell scripting. Simulation and debugging tools were developed and utilised in the reference network to aid development and testing. A patent application was also taken out on a serial interface kernel level driver that was developed during the product implementation.

A feasibility study, system specification, item development specification and a test specification were delivered per technology for evaluation, approval, and final integration into the production framework by IT. The developed software, scripts, filters and view definitions formed part of the item development specification deliverable.

The methodology of the rational unified process and solution value chain (SVC) were followed throughout the project. Development was based on the pillars of iterative development, early risk reduction and use-case driven development. Risks were identified and eliminated in the...
early stages of each technology sub-project. This enabled accurate project time and budget estimates that could be adhered to.

**Challenges faced and lessons learned**

The scale of the project and amount of technologies and technology domains involved brought about many challenges. Various technology suppliers and vendors' involvement were required to provide the information and approval of certain proposed solutions. In some instances progress was hampered by delays in the drawing up of non-disclosure agreements, and the lack of detailed technical documentation.

The presence of legacy and non-standard interfaces, as in most communication networks, required innovative thinking. The scale of the network, which reaches across international borders, also brought about many challenges. Security issues and firewall access increased the complexity of the implementation measurably.

Effective cross-functional teamwork and smooth communication was the keystone for success. Interfacing the technologies required input and cooperation of people across multiple technology domains and service organisations within Telkom.

Skilled resources, the availability of open source tools, and relevant and timely vendor training also contributed to the successful completion of the second phase of development and implementation.

Getting the bigger picture with a centralised fault management platform ensures focused efforts in providing a world-class telecommunication service to our customers.

Contact Peet Badenhorst, Telkom, Tel (012) 529-7372, badenpj1@telkom.co.za