December 2006

TECHNOLOGY STORY

NOC revelation in digital revolution

In support of the digital revolution and the trend towards multiplexing and shared infrastructure, network automation is now in the spotlight as the heart and brains of the terrestrial broadcast network, writes Steve Minahan, Operations Manager, Broadcast Australia.

The new era of digital terrestrial broadcasting has introduced many technological challenges. Not least among these is the ongoing transformation of individual broadcast sites to support the wide range of new services on offer—from digital television, digital radio and emerging mobile TV. This potential explosion in the total number of services places new emphasis on the performance, efficiency and scalability of broadcast network management, particularly given the multiplicity of technology platforms and the added complexity of the digital signal.

These days, most terrestrial broadcast transmission sites across the world are unmanned. Content is contributed, distributed and transmitted using advanced network automation technologies that can span the breadth of an entire nation. Complementary to the ‘Automation’ systems found in the studio, network automation involves the remote monitoring, operation and management of transmission sites deployed across a wide area. It is a critical element of the broadcast network, ensuring the highest availability of services in the most cost-efficient manner possible.

One of the primary goals of any automated network is that the individual unmanned transmission sites essentially run themselves. This relies upon built-in resilience and redundancy of equipment on site, including transmitters and input streams—and especially power generation. Each site also needs sufficient intelligence and local control for everyday operation, and to handle minor incidents automatically, without external intervention.

There will, however, invariably be incidents that surpass the local (on-site) automation capabilities of any given site, and this is where a sophisticated network operations centre (NOC) is of utmost importance. With a communications connection to all transmission sites, the NOC constantly monitors the status of all services in the network, responding to any that raise an alarm. Ideally, most faults are remotely handled by a NOC operator, with minimal (if any) disruption to the service in question. Through the configuration of Broadcast Australia's delivery network, around 80 per cent of faults can be swiftly and easily rectified by a remote reset of equipment from the NOC. This provides prompt restoration of service, while avoiding mobilisation of a field maintenance technician.

Taking the pulse

For any given transmission site, several critical parameters associated with each service and the site as a whole will normally be monitored. These include the input feed and equipment (such as satellite/microwave link or off-air receiver/repeater), transmitters and associated ancillary equipment (such as modulators and exciters), antenna systems, environmental control equipment (such as air-conditioning) and power.

The conventional 'arms and legs' of a typical automated network is a fleet of remote telemetry units (RTU) located at the broadcast transmission sites. With the right inbuilt intelligence, an RTU will dial-in to the NOC and raise an alarm for a particular piece of equipment, sending a voltage pulse to indicate status. These simple 'contact-closure' alarms are very effective at announcing a problem.

Nevertheless, digital broadcast platforms are more complex than analogue, requiring more advanced remote monitoring and diagnostic functionality. Long used in the IT and telecommunications sectors, 'simple network management protocol' (SNMP) communications are now finding widespread application in broadcast networks as part of the network automation system. SNMP offers a vast quantity of specific and detailed information that is not available with conventional contact-closure monitoring techniques.

The integration of SNMP communications represents one of the major challenges associated with digital broadcast network automation. Despite its superior diagnostics capability, SNMP is not as practical as a primary alarming system—simply because it offers too much information.

For example, a transmitter might be wired for five contact-closure alarm points and 1200 SNMP attributes. If the latter were used as the primary alarming system, the NOC operator may have difficulty isolating the heart of the issue due to the sheer number of alarms. The most practical solution here is to use contact-closure alarms to succinctly identify the primary fault, complemented by SNMP information to provide diagnostic functionality in the event additional data is needed.

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Harnessing SNMP

As the digital revolution marches on, however, equipment manufacturers are increasingly offering SNMP connectivity as the only communications option on modern equipment. This means that network owners will need to develop efficient methods of harnessing SNMP as a primary alarming system, as new services are rolled out. The challenge will be to identify the root of the problem.

In addition, the sheer volume of data associated with SNMP, whether utilised for diagnostics, alarming or trending, demands a broadband connection—something that is not always available in more remote locations. This need for high-speed, high-volume conduits for digital data is not unique to the broadcast industry. The world over, digital backhaul is placing strain on existing infrastructure.

One area where SNMP is proving invaluable is in the validation of the digital input stream to ensure it meets the required tolerances. Where digital video broadcast (DVB) platforms are in use, the ETR 290 standard, *Measurement guidelines for DVB systems*, outlines these measurement techniques and tolerances of the digital signal. Typical parameters that are monitored include those associated with decodability of the signal, transport and timing, and application data such as audio/video buffer.

In all, the digital signal requires up to four times as many checks or alarm points to provide the same level of monitoring and 'confidence assurance' as achieved with an analogue signal. Monitoring of the analogue system could be achieved with simple contact-closure alarms; but the sheer number of digital parameters—and the need for detailed diagnostics in a dynamic environment—requires the sophistication of SNMP for monitoring digital streams.

These digital transport stream checks are key to the reliable operation of a multiplex (MUX) of multi-channel services. The multiplexed transport stream also contains data about the video and audio services, which is used by the receiver/set top box to help decode the signal (among other things). Any faults or errors with this data can disable a service and could interfere with other DTV services within the MUX. It is therefore vitally important to monitor the MUX output stream—as well as the various input streams—to assist with identifying whether a fault was generated internally within the site, or whether it occurred upstream (for example, errors introduced at the source, off-air, microwave link, telco link or satellite).

Shared not squared

Owing to the spectral efficiency of digital broadcasting, the industry is heading more and more towards multiplexed systems and shared infrastructure. This requires a deal of collaboration and cooperation on the part of broadcasters as they move away from a ‘one channel, one network’ model. The ideal scenario is a common national digital broadcast infrastructure, whether operated by a consortium of broadcasters—as is already happening in some parts of Asia—or managed by an independent broadcast services provider. This allows the capital investment involved in digital deployments to be shared.

A common broadcast infrastructure also paves the way for a common network automation system. Not only does this make sense from a capital expenditure (capex) point of view, but it is undeniably the most efficient from an operational expenditure (opex) perspective as well. The challenge here is to develop a management/software platform that embraces a complex mix of broadcast technologies—analogue TV and radio, plus digital TV, radio, mobile TV and so on. Once this is achieved, however, a single NOC can monitor, operate and maintain a cocktail of services from numerous different content providers on behalf of multiple stakeholders.

This includes the MUX. The introduction of multiplexing is undeniably one of the main drivers towards shared digital infrastructure, since it invariably involves splicing together the content from different content providers. Moreover, as the industry moves towards mobile TV, this trend is likely to escalate as both the signal complexity and the number of channels to be multiplexed increases. This will place greater emphasis on the need to monitor input streams for validity and error checking prior to multiplexing. By integrating monitoring and control of the MUX into the network automation system, the greatest possible efficiency is achieved. The MUX thus becomes a natural inclusion in the common broadcast infrastructure.

In fact, a network automation system need not be limited even by national borders. Once the system is in place, it is easily scaled up to encompass additional services—whether located in the next province or in the next country. Any transmission site with some form of communications connectivity can be monitored by a single NOC. Once connectivity is installed on-site, integration into the automation network involves little more than developing the appropriate software interface.

Isolate, interrogate, remediate

Network management software is a key element of any efficient network automation system, and impacts the ability of an operator to isolate a problem swiftly. This means the alarms need to be filtered to facilitate interpretation for the operator, allowing further interrogation of the system if required. Similarly, a complementary fault management system is critical for swift remediation of any fault, which may include liaison with field technicians or the provision of service information to content providers. The Internet too is playing its role, providing additional visibility and accessibility into the system.

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By leveraging the broad range of IT tools available, broadcast network automation truly provides a cost-effective means of network management while maximising availability. As a case in point, across Broadcast Australia's network of approximately 1600 services and 600 sites, a typical day might raise 200 alarms—the vast majority being minor and requiring little intervention. A severe weather front might induce 1000 alarms in an hour. These alarms are handled by three on-duty NOC operators; any required field responses are supported by approximately 100 technicians. Ten years ago, 800 field technicians responded to far fewer faults on just 1100 services. On-air service availability of the network has never been higher.

From the multiplicity of platforms and stakeholders, to the technical revolution of digital technology, the broadcast landscape is undergoing dynamic renovation. There is no question that network automation is evolving to meet the needs of this ever-changing environment. Through an increased focus on multi-platform monitoring and control, its nature and role have been utterly transformed to form the heart—as well as the brain—of the network. Advanced network automation is now truly in the spotlight as the key to any future-proof digital terrestrial broadcast network.

Steve Minahan, Operations Manager, Broadcast Australia: Network automation underpins the ever-changing broadcast environment.

Company background
With over 70 years' experience as the owner and operator of one of the most extensive terrestrial broadcast transmission networks in the world, Broadcast Australia provides end-to-end transmission services for radio and television (analogue and digital) broadcasters. The company's core competencies include planning and network design, engineering design and project management, complex systems integration, site development and installation, operations and network management and in-house repairs and maintenance.

Broadcast Australia also develops world-class solutions and applications for new and emerging technologies—such as Infocasting, Digital Radio and Mobile TV—working with strategic partners throughout the Asia Pacific region. Subsidiary companies include Hong Kong-based confined space coverage group, Radio Frequency Engineering Limited (RFE), and systems integration and product supply specialist, The Bridge Networks. Broadcast Australia is a 100% owned subsidiary of Macquarie Communications Infrastructure Group, an entity listed on the Australian Stock Exchange (ASX code: MCG).

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