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CASE STUDY

Australian DTV delivers 'digital difference'

After nearly a decade in deployment, Broadcast Australia's digital terrestrial television broadcast network has reached a key milestone. Mike Dallimore, Broadcast Australia Vice President International Business Development, explores the challenges of the massive project, providing insight into key lessons learnt and what constitutes the 'digital difference'.

In August this year, Broadcast Australia launched its 500th digital terrestrial television broadcast (DTTB) service. This marks a significant milestone in a nationwide digitisation project aiming to provide fully managed television transmission services to Australia's two national broadcasters and several regional commercial stations. Spanning almost a decade, it has been a digital journey of untold challenge and engineering effort, demanding technologies to be pioneered and new skills accumulated.

Catalysed by a federal government mandate to commence DTV broadcasting by 01/01/01, Australia was one of the first countries in the world to deploy DVB-T services. Field trials of the fledgling DVB-T standard were carried out in Sydney and Canberra in the late 1990s, around the time of the standard's adoption by the national communications regulator, the Australian Communications and Media Authority (ACMA). Now, some ten years later, nearly 100 per cent of the widely dispersed Australian population has access to DTTB services and a great deal has been learnt about the planning, design, deployment and ongoing management of digital broadcast networks.

Start with spectrum

As a starting point, spectrum was assigned for DTTB services in both the VHF and UHF bands, which are also used for analogue television services in Australia. There followed an important period of network coverage planning and system design. ACMA had stipulated that digital coverage must equal that of existing analogue services, and that analogue and digital services would be simulcast in the years before analogue was switched off.

Sophisticated software tools were used to model coverage, accommodating the well-documented 'cliff effect' in digital systems, where the picture quality abruptly deteriorates to become unwatchable. It was also necessary to protect the existing analogue channels from interference by the digital services. In many cases adjacent channels were being used; therefore where necessary the digital signal was power limited to prevent interference. To help control interference further and streamline infrastructure requirements, it was assumed that multiple digital and analogue channels would be broadcast via a combined antenna system.

In addition, the spectrum plan identified around 20 areas nationally to be covered using single-frequency networks (SFNs), where multiple transmission sites operate on the same frequency. Here, the content, frequency and timing of the signal at the receiver are critical. Again, software modelling tools were used to design these sophisticated systems, where the location of transmission sites, ERP levels and signal modulation schemes were predominantly fixed, leaving site launch timing as the main variable for tuning the performance of the SFN.

Digital difference

It soon became clear that digital technology is vastly different from analogue, particularly from a system design and integration point of view. The program signal undergoes several digital processing steps before it is broadcast, including encoding and multiplexing. Achieving interoperability between the different electronic elements of the digital system demanded extensive equipment evaluation and trial integration. In the early days of DTTB, such equipment wasn't necessarily provided by the same vendor, making integration more complex.

This difficulty was raised another degree by the shift towards IT-based technology and systems. For an industry accustomed to relatively simple analogue instruments that had been in place for up to 20 years, the transition to highly sophisticated digital 'black boxes' required a completely new skill-set to complement the existing RF broadcast expertise. Broadcast Australia transformed its team into 'digital experts' in order to integrate the transmission system and undertake the massive deployment.

Launched on 1 January 2001, the first national and commercial DTTB services covered Australia's main metropolitan markets of Sydney, Melbourne, Adelaide, Brisbane and Perth. Since that date, Broadcast Australia has progressively rolled-out services through regional centres, translator sites, major tourist areas and remote rural regions, with the 499th and 500th transmitters recently switched on at Mount Read in Tasmania.

Each of the sites—most of which support multiple DTTB services using common infrastructure—was individually assessed in terms of logistics, access and existing infrastructure that could be reused or modified. A single project engineer was responsible for streamlining the entire design and implementation process at each site. One of the most important considerations was the minimisation of disruption to existing services during the upgrade.

It was also necessary to upgrade the program distribution systems that support the transmission sites. The enormous volume of data associated with DTTB services, particularly HDTV, meant that additional data handling capacity was required. Owing to the high number of remotely located sites in Broadcast Australia's network—many being hundreds of kilometres from a city—these program distribution systems are largely satellite links; upgrading the capacity of these links involved negotiations with the satellite provider. In other cases, microwave and fibre optic links were upgraded.

Mandatory monitoring

The final stage of deployment of each digital service has involved its integration with Broadcast Australia's network operations centre (NOC), located at the Gore Hill transmission facility in Sydney. The NOC monitors and operates the entire network, which covers an area of almost 77 million square kilometres, comprises nearly 600 individual unmanned sites, and supports over 2200 digital and analogue television and radio services.

Since the first DTTB services were deployed, the NOC itself has undergone several upgrades in order to support the vigilant monitoring required by digital systems. Opportunities for error exist throughout the entire life of a digital signal—from the content source base code, through the encoding and multiplexing of the transport stream, and the transmission and reception of the RF signal itself. This means end-to-end monitoring of digital services is essential to ensure signal integrity. Moreover, since Broadcast Australia provides independently managed transmission services, there is a need to isolate individual programs within a multiplex and demonstrate assurance that these programs are going to air correctly.

Increasingly, digital equipment is providing this information in the form of simple network management protocol (SNMP), which requires new network management philosophies. Faced with a flood of data, it has often been a challenge to identify the essential information; however, experience has helped the isolation of critical data from that which is merely 'nice to have'.

Lessons learnt

The importance and complexity of signal verification and network operations is unarguably one of the key lessons Broadcast Australia has learnt as a result of this unique project. This is closely coupled with the need to consider continuously changing technology; ten years ago, the rapidity with which digital broadcast technology has advanced could not have been predicted. Equipment is being superseded regularly, providing ongoing integration and interoperability challenges, and highlighting the need to continue developing skills. This rapid equipment evolution, added to an intrinsic complexity, also ensures that component lifecycle is significantly shorter than that of analogue equipment.

Governments and broadcasters on the brink of DTTB deployment for the first time have the opportunity to make choices with the benefit of time, hindsight and the experience of those who have already trodden this path. To promote consumer take-up it will be important to provide the service demanded by consumers: all present indicators point towards high-quality widescreen HDTV 1080 and increased content choice. This means that spectrum will need to be put aside for multiple HDTV services, and the latest efficient evolutions of standards—such as DVB-T2 coupled with MPEG-4—factored in.

Broadcast Australia's DTTB network deployment is not yet complete, although it currently services 97.3 per cent of Australia's widely dispersed population. Ultimately, coverage will be provided to the entire population before analogue television services are switched off in a few years time. In the meantime, recently released figures from ACMA state that penetration of DTTB take-up in Australia has just reached 42 per cent, up from 30 per cent in 2006 and 13 per cent in 2005.

Much knowledge has been gained from the past decade's experience, providing valuable insight into what constitutes the 'digital difference' and how best to approach similar deployments in the future. One thing is certain: the technology keeps evolving and network operators cannot afford to stand still. It is essential to keep focused on the needs of the future to ensure that today's networks will be able to meet tomorrow's consumer expectations.

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Broadcast Australia's Gore Hill transmission site in Sydney is at the hub of its massive nationwide DTTB network.

Company background

With over 75 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), digital media network/infrastructure specialist Singapore Digital, systems integration and product supply specialist The Bridge Networks, and critical application and hosting provider, Hostworks.

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