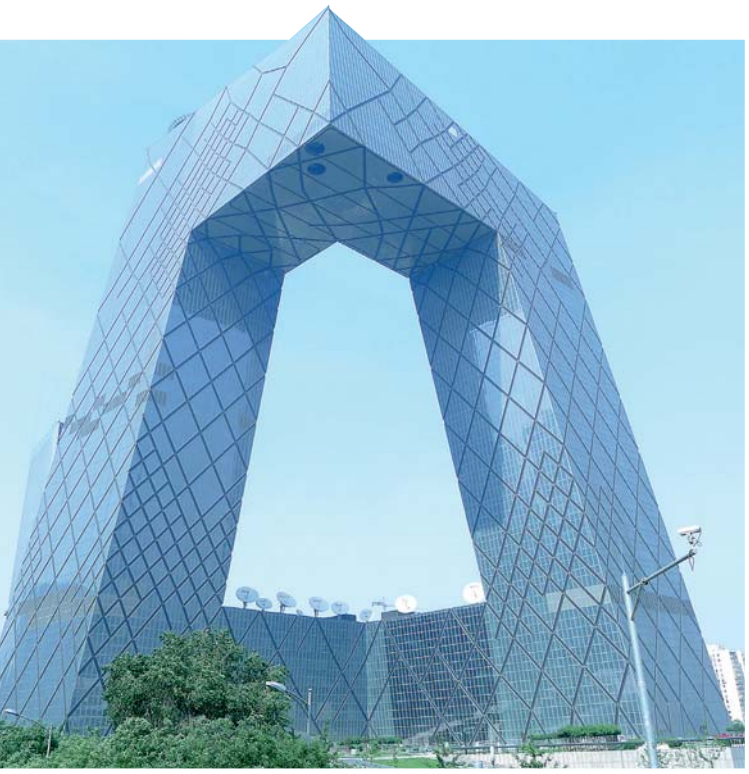

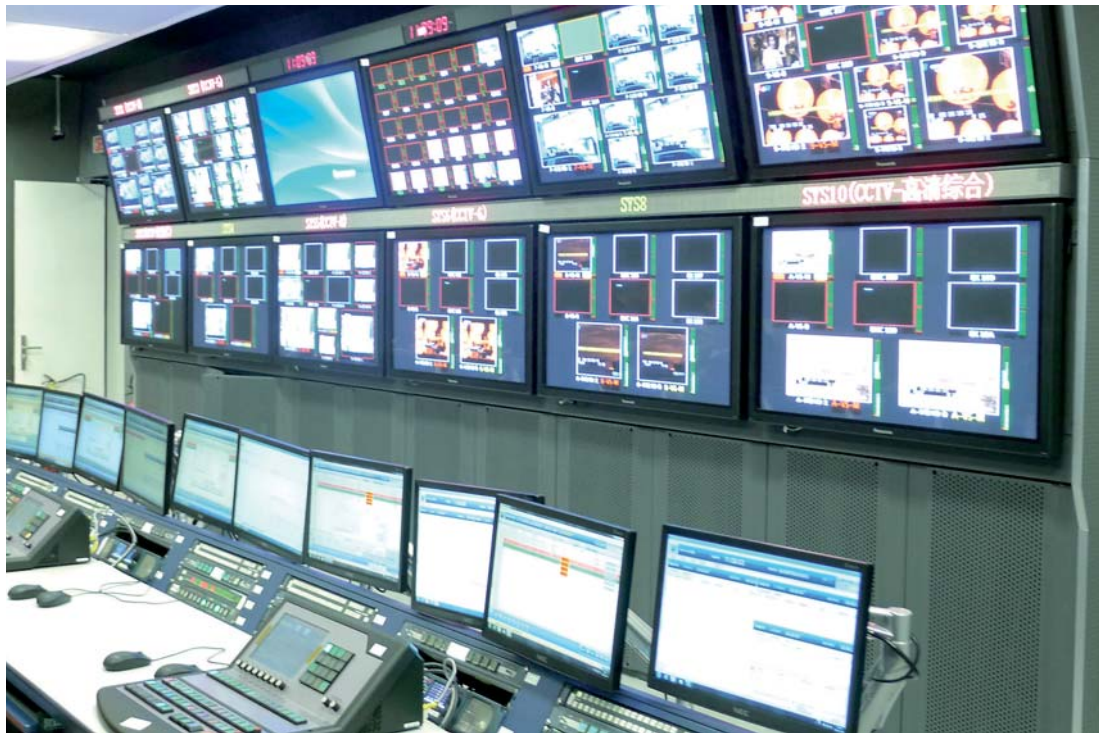

One of the five control rooms

Inside CCTV

The new home of China's CCTV is an impressive sight, but the technology within is even more striking. **Richard Lawn** takes a tour

WITH THE SWITCH FROM ANALOGUE to digital, broadcast television systems encoding or formatting standards for the transmission and reception of terrestrial television signals are required to combine NTSC, PAL and SECAM systems within a single transmission system. By integrating a set of technical parameters for the broadcasting signal, an encoder system for encoding colour and a system for encoding multichannel television sound (MTS), a heterogeneous network has thus been created. Whilst this has proved to be a huge technological challenge for systems integrators and engineers carrying out the conversions, the situation with worldwide digital television is simpler by comparison.

Most current digital television systems are based on the MPEG transport stream standard, and use the H.262/MPEG-2 Part 2 video codec. They differ significantly, however, in the details of how the transport stream is converted into a broadcast signal both in the video format prior to encoding and in the audio format. This has not prevented the creation of an international standard that includes both major systems, even though they are incompatible in virtually every respect.

There are two principal digital broadcasting systems. Whilst the ATSC standards developed by the Advanced Television Systems Committee have been adopted as the standard in North America, Digital Video Broadcast Terrestrial (DVB-T) has been adopted by the rest of the world. This system transmits compressed digital audio, digital video and other data in an MPEG transport stream, using coded orthogonal frequency-division multiplexing (COFDM) modulation. Rather than carrying the data on a single radio frequency carrier, OFDM splits the digital data stream into a large number of slower digital streams, each of which digitally modulate a set of closely spaced adjacent carrier frequencies.

DVB-T was designed for format compatibility with existing direct broadcast satellite services in Europe, although Japan uses a closely related third system called ISDB-T. The People's Republic of China has developed a fourth system named DMB-T/H. This fusion system is in essence a compromise of different competing proposing standards designed by different Chinese Universities, incorporating elements from DVB-T, ADTB-T and TiMi 3. Within a geographical area, the format allows single-frequency network (SFN) operation, where two or more transmitters carrying the same data operate on the same frequency. In such cases the signals from each transmitter in the SFN needs to be accurately time-aligned, which is done by syncing information in the stream and timing at each transmitter referenced to GPS.

In the CCTV control room – Tao Lin, Jolly Yang, Song Xuan and Sony Ein

One of the five racked rooms for each of the control rooms used for CCTV's transmissions

Coinciding its own switch from analogue to digital transmission with a relocation to new headquarters in Beijing, state TV broadcaster China Central Television (CCTV) was able to design its new transmission system on a blank canvas.

Founded in 1958, CCTV has a network of 22 channels broadcasting a mixture of documentary, comedy, entertainment and drama to more than one billion viewers. On September 2nd 2008 the new CCTV headquarters was opened, marking the organisation's 50th anniversary. The new building is an iconic anti-skyscraper that was delivered in time for the 2008 Beijing Olympics, changing the architectural image of China's capital city. The two L-shaped, glazed 234m towers link at

the top and the bottom at an angle to form a loop, which is often referred to as 'the trousers'. The linking level features 4m-wide glass floors which allow visitors to peer down a 162m drop. Once fully operational, the CCTV tower will employ 10,000 people.

CCTV contracted CSS to assist in the design and installation of the digital transmission system at the new site, where the five operational control rooms can each manage 10 TV channels.

The 10 rack rooms are constantly monitored for changes in temperature. As heat from the racks increases, cold air is pumped into the rooms in order to achieve equilibrium – and vice versa. Temperature sensors are affixed to each vertical rack and the results of any changes are detected remotely on PCs at the old CCTV site. In the event of an emergency, overhead windows automatically open up. Likewise the intelligent system that has been installed also detects changes in incoming power supplies, electrical voltages and currents.

The broadcast signals of the programmes loaded onto Harris Nexio Omneon compressed domain servers are transmitted with delays if need be. Two HD video signals are transmitted per channel, which can be converted down to SD as required. They are then processed via Harris 6800 converters, three of which are dedicated to each channel. From an AMP network switcher the signals are then sent through Harris Panacea switchers and onto Miranda Kaleido-X multi-viewers for screening in the control rooms. Two frames are available with up to 96 inputs and eight multi-viewer outputs (7RU).

The decoding of the colour signals generated from Dell servers are fed through Tektronix Ecco 422D changeover units, which manage and synchronise the SD-HD conversions. They can accommodate component or composite serial digital video signals, AES/EBU digital audio, tri-level sync and analogue black burst signals. The resultant signals are then fed through Canare patchbays to Miranda nVision NV5100 multi-channel master control switchers and onward to Blend Orad Master Videographic blending servers before being synchronised onto the network and into the control room screens.

Two TC Electronic DB8 Mk II units are dedicated to each channel in providing the Multichannel Television Sound (MTS). Consistency in loudness is an overriding criteria in broadcast and as DB4 units were successfully used at the old CCTV studios, the next generation DB8 MkII digital transmission processors were deemed as the logical next step up, providing real-time loudness control and format conversion of both analogue and digital feeds from the same machine. Four processors can be applied to different processing needs, but in the case of CCTV to a combination of one stereo and one 5.1 signal.

The DB8 MKII units come with dual power supplies receiving their power from two independent sources, thus ensuring redundancy. Capable of handling up to 16 audio input and 16 audio output channels and with two slots available, any combination of SDI, AES/EBU unbalanced or AES/EBU balanced can be selected. Two different MPEG-TS signals can be transmitted at the same time, using a technique called Hierarchical Transmission, which transmits a standard definition SDTV signal and a high definition HDTV signal on the same carrier (the SDTV signal is generally more robust than the HDTV one). At the receiver, depending on the quality of the received signal, the STB may be able to decode the HDTV stream or, if signal strength lacks, it can switch to the SDTV alternative. The DB8 MKII interface is controlled directly with standard master control applications, and changes can be applied by using serial control, GPI or Ethernet. A total of 100 processors can then be monitored via SNMP trapping at the old CCTV studios some 15km away via TC Icon software.

Harris Nexio and Clear-Com units

20 TC Electronic DB8 MkII processors are dedicated to transmitting the audio in each of the five control rooms

CSS engineer Song Xuan and CCTV technical engineers Song Ein and Tao Lin have spent many years between them installing the resultant transmission system.

'Installing the video servers and switchers was extremely challenging,' Mr Xuan freely admits. 'Without a switcher, you cannot have a signal and then you cannot do anything. The power supply was also a problem for us. The content for every channel is stored in different video servers, all of which have different networks, different controls and technical structures. Then if one server goes down, you need to have a back-up.'

Omneon Spectrum video servers

Having started the project back in 2009, Tao Lin declares that some of the equipment specified three years ago is possibly already out of date. 'Technologies and servers change. We specified some of the equipment based on the old CCTV set-up and this platform already needs an upgrade. But that's the exciting challenge of working in this industry – it's highly dynamic.'

The transmission rooms may not be as eye-catching as the visually stunning building in which they are housed, but they were just as demanding when it came to their construction. The control rooms are managed calmly and without fuss – a testament to the thought and detail that was applied in their design and build.

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