Part of our achive series looking back at past developments; this piece is in recognition of the immense contribution to the broadband and cable industries made by SCTE Director Roger Blakeway.

Some video aspects of a cable TV system headend

by DR ROGER BLAKEWAY

Proceedings at a meeting of the Society of Cable Television Engineers on 9th June 1987 at the Institution of Electrical Engineers, Savoy Place, London WC2, the President of the Society, Mr. A. Burke occupying the chair.

Introduction

This talk forms part of an informal series of lectures based on the Westminster Cable TV system. Last year John Power of British Telecom described the design and implementation of the fibre-optic based switched star system that we have in Westminster and my presentation today will be system wide.

I will try not to duplicate ground already covered and will concentrate on the aspects of generation and control of that other sort of software namely the programme material that is transmitted on the network.

I shall outline some of the problems that arise in the design and operation of a modern multichannel control and transmission facility and the solutions that we have adopted to solve them in a cost effective way.

Since, to use a well worn phrase "a picture is better than a thousand words" I shall end my presentation with a short video showing many of the features mentioned.

The Westminster service

The Westminster switched star system is in essence a wideband telecommunications network. It can support both downstream and upstream video, text data services, point-to-point data links, message switched data, telephony and almost anything else representable in an electrical form. The timing of the implementation of these services is crucial from both the technological and economic viewpoint. As with other cable operators our first priority is the supply of entertainment products in order to attract the highest possible subscriber penetration as we build the network. The added value services will come later ... but not much later.

The services I will concentrate on today are the three that are live on the network: television, text services and video library. In the case of the latter 'live' should be construed in the engineering sense rather than commercial.

Dr Blakeway is head of technical operations at Westminster Cable Television. Having joined them at the start of their service he was responsible for project managing the design and construction of its transmission control room. His other responsibilities include computer systems and customer services as well as the transmission and quality control of programmes delivered on the network.

Dr Blakeway obtained both BSc and PhD degrees at Birmingham University, the latter in Electronic physics. He spent several years in Lucas Industries working in semiconductors, integrated circuits before spending a period with the M.O.D. on secondment. A gradual move into systems lead him to Scicon where he was divisional head of engineering.

His cable career started with Racal-Oak where he was technical manager. His achievement there included the transfer of production of satellite encryption equipment from the USA to the UK and the project management of the development and production of the 20,000 set-top units supplied to Aberdeen Cable, together with control and administration software.

Television

Westminster Cable TV is currently transmitting 19 television channels, 20 within the month and 24 in the near future. The system is designed for a full 30 channels in total. Let me say at the outset that we do not pro-duce any of our television material in-house, our activities are limited to sourcing, assembling, playout and control of transmission of the programmes.

Dealing first with the source of material: We have the usual mixture of satellite and tape delivered programming and, perhaps a little unusually, a telephone delivered service, more of this later.

Westminster Cable is not ideally situated in Baker Street for mounting large satellite dishes on our roof and our source is in fact 2km away. Two 3.7 metre dishes are on the roof of the Lords Telephone exchange

*Westminster Cable Television

and the multichannel feed to Baker Street is by a studio grade fibre-optic link. These links are similar to the normal network circuits except that only two video channels per fibre are used instead of four. Wegener derived stereo sound for simultaneous FM radio transmission is also transmitted by fibre, Sony PCM equipment is used and the digitised data stream occupies a normal video channel. One exception to the above is our live news feed from Dubai TV every evening on our Arabic channel. This comes via an Indian Ocean satellite, downlinked at Madley Earth Station, microwave/land line to the British Telecom Tower and then fibre optic to Westminster Cable.

Video signals received at Baker Street are optically demodulated and video and sound presented at base-band for processing at nominal 1 volt and 0dBm respectively. In the simplest case, that of a live satellite transmission, the signals are monitored for quality, the levels adjusted where necessary and then launched into the network. The only other activity associated with such channels i.e. Premiere, Childrens, Screensport is the provision of a caption out of transmission hours.

In the case of Arts, Lifestyle, Worldnet and the Music Box segment of Superchannel there is a need to record and playout the material to provide a more 'user friendly' channel .... Arts over cornflakes is not everyone's cup of tea! Arts, Lifestyle and Music Box are in fact presented as channels in their own right, Worldnet is used as live news inserts into our Reuters rolling text channel.

Two of the tape delivered channels, Home Video Channel (HVC) and Bravo, are scheduled by the programme provider and only need to be played out at the appointed time. The Arabic channel tapes are supplied against an outline schedule e.g. 10 minutes Koran, 40 minutes wrestling, 70 minutes drama etc. and the material has to be assembled, timed and continuity provided by us.

The telephone delivered service I mentioned earlier is in fact a modem data link to Reuters. A BBC micro is used to provide a carousel of 30 plus text screens and a PAL coder is used to ensure a satisfactory video output to the system. The content and number of pages changes as news becomes available or is superceded; The aim is to provide an up-to-the-minute world, sport

3.7 metre satellite dish on the B.T. Lords exchange building.

and financial news service. A local editing terminal is available to insert advertising pages into the carousel sequence if required.

The large number of channels causes problems in monitoring and control from both operational and cost aspects. We are all aware of the economics of Cable TV systems in the early years and it is essential that a control room should be designed and constructed at minimum cost, be easy to maintain and be staffed by as few people as possible. It would be pointless to consider providing 30 sets of traditional single channel suites (Preview, transmission, caption, VTR monitors, universal crossbar switching; vision and sound fade/mix facilities). The cost would be enormous, the system over complex and several skilled operators would be needed to run and maintain it. An additional complication is that all the off-air and satellite channels are asynchronous; unless one is prepared to consider frame-store buffers for every one of these sources the concept of master sync is impossible. This has obvious implications if any mixing/fading of video is being considered.

It must be said that there are as many ways of designing a control room as there are designers. The solutions adopted by Westminster Cable are coloured by the background of the specification and design team and the operational concepts they envisaged. We would not

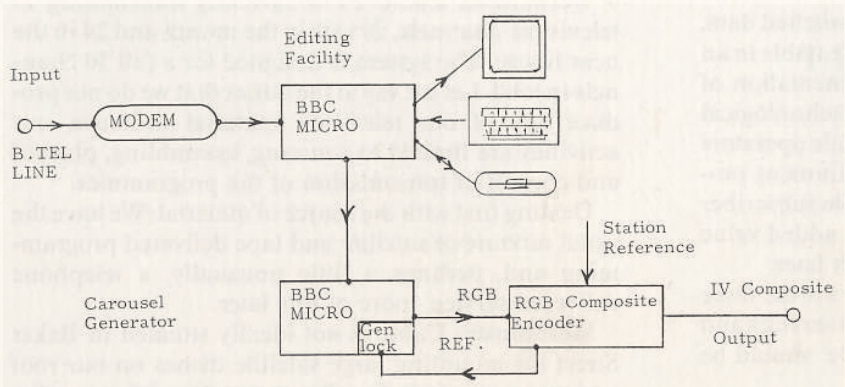

Fig. 1. Generation of Reuters text service.

presume therefore to suggest that the following description is the only or indeed best way of doing things ... only that it suits us.

The overall concept is that of dedicated processing channels. Twenty four channels are presently catered for and video and audio essentially follow parallel paths through the system. Each channel has input buffering with level and frequency response adjustment. The signals then pass through a caption insertion switch and are output through a drive amplifier again with level and frequency adjustment. Some of the channels, where time-shifting is required, have a signal take-off from the input buffer for recording and there is an addition insertion switch prior to the caption switch for playout. Control of the switch matrices is remote at the operator's desk.

In general we do not continuously monitor the source material although two monitors can be switched to any of the incoming lines for instance to time caption to line switching. All the output channels are presented to the operator on 14 inch matched phosphor monitors albeit A/B switched to reduce the total number of screens needed. A mobile engineering trolly is available for quantitative measurement and adjustment. This has a 20 inch grade 1 monitor, waveform monitor and vectorscope, PPM meters and a speaker/headphone outlet. There is a remote switching capability on the trolly to monitor any input or output channel plus some critical intermediate points such as caption and Timebase Corrector (TBC) outputs.

The output from the control room is also monitored by a 22 inch sequentially switched monitor, which steps through all the channels with a variable dwell time (about 1 to 20 seconds).

Flexibility in the system is maintained by interconnection of all amplifiers, switch matrices, VTRs, monitors etc. through video and audio jack fields. We use low-band U-Matics with TBCs for all recording and playout with the exception of the Arabic Channel. This has a self-contained assembly/playout suite of high-band machines. Signal levels throughout the system are preset to operate a 'unity gain' regime. There are no video or audio level controls at the operator's desk. With some channels this has proved to be a false economy since one or two programme providers seem to regard line up bars and tones as front end window dressing and tapes quite often vary from reel to reel.

All switching is 'hot cut' with no mixing or fade facilities even for audio. The switch matrices are frame synched to the station reference and therefore will cut without disturbance between TBC outputs and captions: There is less guarantee of a smooth change when cutting to and from live feeds.

Turning now to problems of captions; With 20 channels now and 24 soon we should ideally have the ability to produce 24 different captions to maintain channel identity. Luckily, statistics come to our aid and it is rare to need anywhere near this number simultaneously except in the wee small hours when we can relax slightly on the presentation standard.

The choice of caption generator system at build time seemed to be between using several individual text type generators or a more professional 'paintbox' type system for composition with several output channels. We regard the intermission and out of hours presentation as crucial to maintain a professional image and we therefore took the latter approach. The system chosen is based upon the 'Image Artist' package. This allows us to create in-house high resolution graphics, store them digitally on disc and recall them when needed. The system has eight Pluto frame stores at its output and together with a distribution matrix allows any of 8 captions to be routed at one time to any of the 24 TV channels. Incidentally we have background music played out with all captions using continuous play twin cassette decks.

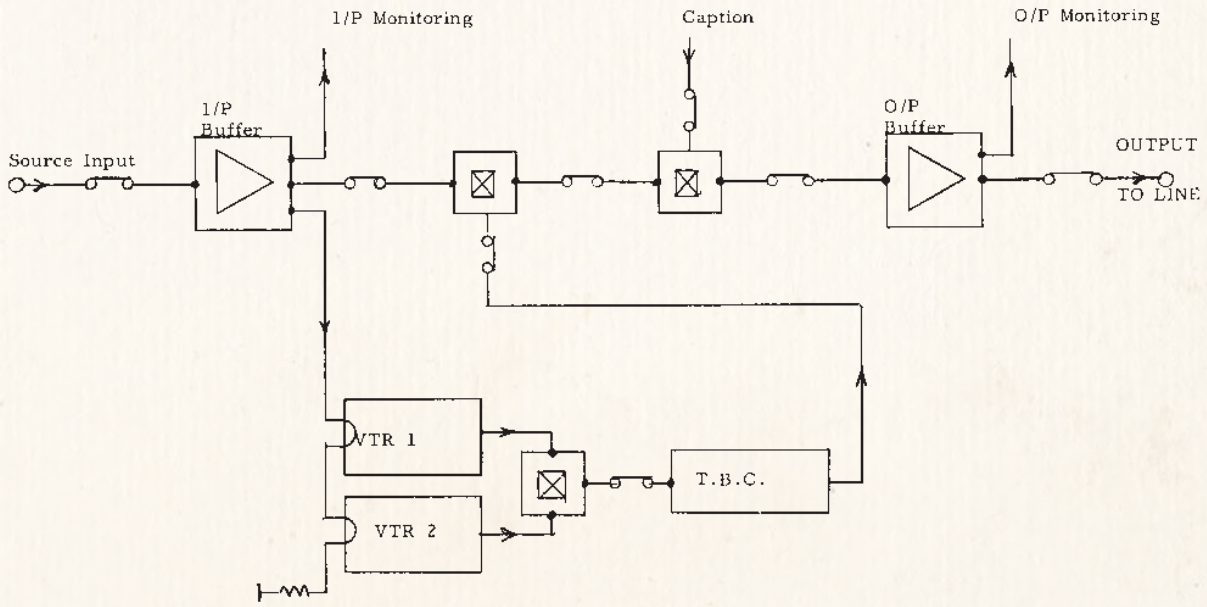

Fig 2. Simplified outline of single video channel.

The split screen display produced by the VideoPlex unit.

One feature which we were the first to introduce into cable networks is the full colour split-screen concept. We devote a TV channel to this display and use it as a guide to 'what's showing now', as an information medium using 'crawlers' across centre picture and a premium package promotion tool. The channel is well liked and many viewers watch it for extended periods! You will see the variations we can play with the display in the following video, let me just elucidate here how the display is generated.

Each input channel has a video A to D convertor, pixel compression circuitry and asynchronous access to a frame store. The output from the frame store can be synced with the control room master reference. A facility for overlaying text onto the output screen is provided, this has automatic background contrast control to ensure legibility. We have added an external input switch matrix to allow the contents of the individual display squares to be changed and, in particular, for the sound broadcast on the channel to match the picture currently in the centre square.

In all the above I have studiously avoided any mention of automatic control facilities. We have no overall computerised system, relying instead on implementing specific operator aids where we feel it is justified.

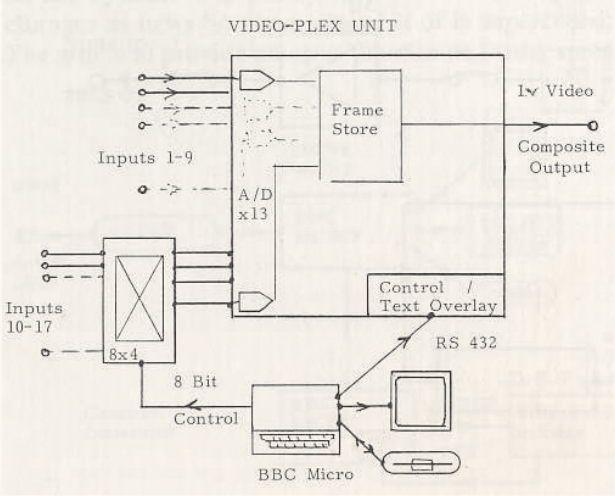

Fig. 3. Control of the Video-Plex unit.

For HVC we have the standard Kavicon cueing system. Bravo, Arts and Lifestyle playout we cue and change manually whilst Music Box and Worldnet are automatically recorded and played out with changeovers controlled by real time rather than with recorded cues. We continually evaluate the need for additional automatic aids to ease the operator task but we have decided against a single all embracing system. We prefer a gradual and graceful degradation of the control room when faults arise and that our operators can easily revert back to manual operation with minimum fuss.

Text Services

I do not intend to spend long trying to describe our interactive text channel; The video will show you the range of material offered and how the facility is used. I will limit myself to explaining how the system works.

The database itself is similar to most viewdata 'Prestel' style systems. The individual pages are under the editorial control of Westminster Cable and indeed most of them are composed at our Baker Street offices before being uploaded via a modem onto the text 'Information Server' computer at the head-end. There are of course facilities for other information providers to input data.

The subscriber uses the system in a similar way to Prestel except that the cable network provides the two way data link rather than the telephone. Requests via the remote control keypad arc passed through the cable network to the headend. The required page is then transmitted by the Information Server to the local switch point using a 2 megabit data link. At the switch an individually assigned text generator is used to convert the data into a 40 character by 24 line display which is sent as a video signal to the viewer. The subscriber does not need a teletext or Viewdata set, a standard TV set gives him full text facilities with a response time significantly better than telephone based systems.

As with Prestel there are response frames, messaging facilities and, since the Information Server is integrated with the system control computers, the subscriber can use this interactive text medium to change his service level, programme his VCR channel with up to 8 selections, change passwords etc.

The system is designed to provide gateways into other databases such as Prestel itself and services such as home banking, home shopping are being developed now and will be available shortly.

The presentation at the IEE ended with a short video showing many of the features mentioned in the paper. The video gave a feel for the operational aspects of running the control room, with a taste of what the subscriber gets for his money. It also showed the video library functioning.

The control room at Westminster, showing monitors, VTR banks and patch panels.

Live coverage of the House of Lords

British Telecom's fibre optic switched star cable television system is now used to distribute live coverage of the House of Lords to viewers. Pictures are provided by Independent Television News in a joint project with British Telecom Vision and Westminster Cable Television Ltd. Coverage of House of Lords debates are transmitted live daily to Westminster Cable's customers in London.

The Lords is the only chamber of' Parliament which currently permits television cameras to be present. The new programme gives viewers the opportunity to watch the day-to-day business of the House of Lords for the first time.

Brian Lawrence, director of British Telecom Vision, is delighted to provide this important service, and is ready to assist with any future expansion of Parliamentary TV coverage.

The coverage, including a commentary by Independent Radio News' political team, will last from the start of proceedings at 14.30 (Thursdays 15.00) until approximately 19.00 from Monday to Thursday when the House is sitting.

Westminster Cable IV covers the City of Westminster, including the West End and Whitehall.