

Annex C – Compression Applications

C.1 The Application Model

The figure below illustrates a generic view of the program chain identifying all the primary application areas. Each of these functions is described in detail below.

portable field editor or fed live must be delivered to the studio for further processing and final transmission.

Communication channels available for this purpose may have a different bandwidth than the recorded compressed

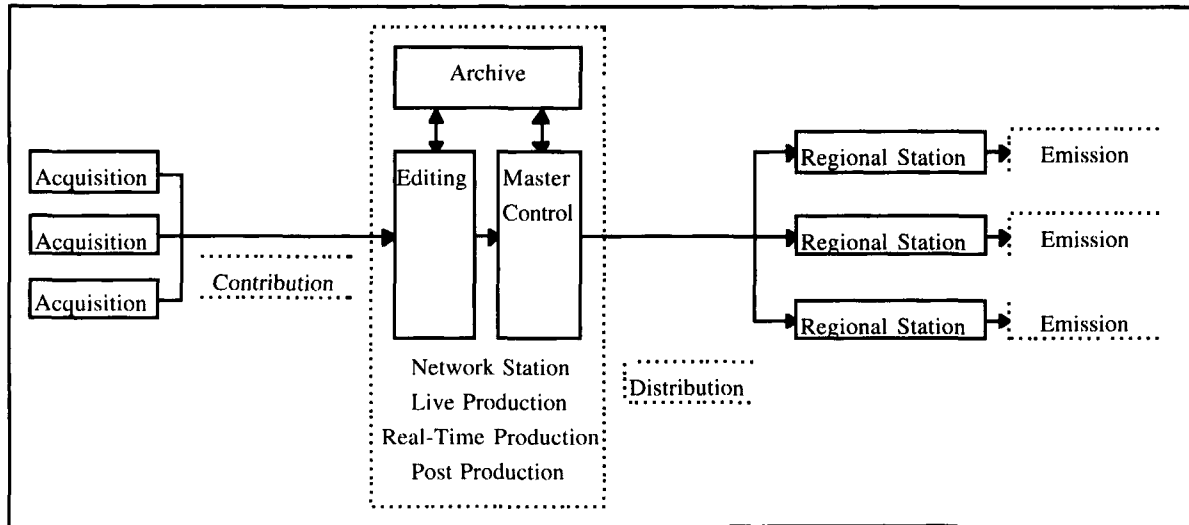


Figure C1 – Generic television program chain.

C.2 Acquisition

Compression offers considerable benefits for field acquisition, e.g., in news, sports, electronic field production (EFP), consumer, and allied uses.

The requirements for equipment for field application are:

- high portability,
- low weight,
- low power consumption (long running time), and
- ruggedness.

The application of compression plays a significant role in meeting these requirements because of the reduced bit rate and reduced need for storage capacity that it yields.

The compression scheme used for acquisition should allow field editing of the signal.

For applications such as EFP and Sports applications a 4:2:2 sampling structure is preferable. Usage of a sampling structure of less than 4:2:2 (such as 4:1:1 and 4:2:0) should be acceptable for News Gathering applications provided extensive post processing is not required.

C.3 Contribution

Content acquired in the field and edited on the spot using a

signal and possibly a different quality of service. It would be desirable for the compressed signal from an acquisition source to fit perfectly into the constraints of the communication medium. However, due to the wide variety of choices in the marketplace (e.g., DS3, E3, and OC-1 through OC-192, with data rates ranging from tens of megabits to gigabits per second) this cannot be practically achieved without resort to the data rate of the lowest bit bandwidth channel.

Where a compression system has a bit rate greater than that of the communications channel, the options are slower-than-real-time transmission (which may not be practical for some applications) or an additional layer of compression, which will lead to concatenation errors and will result in some degradation of picture quality.

In the case where the compression system used has a data rate lower than the communications channel it will be preferable to use a single compression system rather than use concatenated compression systems. The unused bandwidth may be used for other purposes (e.g. extra error protection or ancillary service information).

Satellite contribution service between remote trucks and studios is not always available due to overcrowding of the spectrum for this type of communication. A choice of low

bit rate compression may be helpful in this communication shortfall. However, using this as the only criterion for selection of the bit rate of the compressed signal may have other negative consequences.

Significant input to television news is received in the form of fixed satellite communication. This type of a signal is recorded at the station on a 24 hour basis and selection of the proper compression format is dependent on other criteria which may be different from those of field acquisition equipment.

C.4 Compression in Live/Real Time Production

Use of compression in field production will ease demand on the communication channel between remote acquisition equipment locations and the studio where final production is completed. The application of compression in Live and Real-Time Production has been covered in the sections on Acquisition and Contribution.

C.5 Post Production/Exploitation

C.5.1 Editing in real time

Editing in real time usually involves the simplest of production effects – the cut, implemented by stream splicing in compressed systems. The splice should be done in the compressed domain without transcoding.

It is highly desirable to be able to perform cuts editing on compressed streams with different bit rates. This area of compression processing is currently in its infancy. However, it is becoming clear that this will be possible between streams of the same compression family.

C.5.2 Post production editing

Post Production editing requires the highest attainable quality. During such production processing, layering is very often used. Any processing effects beside cuts require decoding. Layering, as a process, may involve many subsequent re-encodings; therefore loss of picture quality can be a real possibility.

To avoid this loss of picture quality phenomenon, the producer should use methods similar to those used in the past for layering in analogue environments. One of these methods involved the use of higher quality processing and storage formats to ensure that the original signal is degraded as little as possible. Extensive studies have been performed on concatenation of compressed systems and these studies have shown that concatenated compression will have a negative impact on overall picture quality. The analogue practice of editing and using intermediate storage having the highest quality format available is also applicable in the compressed environment. This means that the processing should be done in the uncompressed domain or in the highest compressed bit rate available to the user.

C.5.3 Off-line post production

It is assumed that for off-line post production, the user has less demanding picture quality requirements because this process is being used only for creation of an Edit Decision List (EDL). The EDL is later used for actual editing of the program master. In this manner, a post production facility can utilize high quality, high cost post production equipment efficiently. An important feature of the Off Line Editing station is its ability to facilitate proper editing decisions which can be accurately followed in the on-line environment.

C.5.4 Presentation / Master Control

This type of processing controls the output stream of the station or network. In this environment decisions are always made live and usually under dynamic conditions. The operator must make decisions based on specific situations and therefore response time and repeatability are of the highest importance. At this processing point, the operator has little control over picture quality, only over delivery of picture content.

Reliability of the equipment is also of the utmost importance, and any possibility of failure could have catastrophic consequences for the facility. It is clear that the use of compression will not improve this situation. However, if a facility operates with compressed signals as its primary methodology, it is logical that master control should follow the processing pattern of the facility and switch compressed signals.

Switching in Master Control will take place at the Packetized Elementary Stream (PES) level. This process may be followed by encoding into Transport Streams. Nevertheless, the output picture quality will have been predetermined by previous encoding processes, and the final picture quality will be decided by the bit rate and structure of the released compressed stream.

C.6 Distribution

C.6.1 Satellite links

Satellite links are frequently available as analog channels within which a suitable digital modulation process can be utilized. This allows considerable flexibility in the choice of video compression system bit rates. Where input bit streams have been previously encoded, satellite encoders should use the same coding process as that of the feeder content, or the pre-encoded content should be directly passed to the satellite modulator to ensure no concatenation losses. Where this is not possible (because the available bit-rate is less than that of the pre-encoded bitstream) concatenation losses will be incurred.

C.6.2 Public carriers (telcos)

The issue of Public Carriers has already been covered in the section on 'Contribution' where the same points apply.

Other features of both Satellite Links and Telco Links include the possibility of faster-than-real-time transfers for both cost and operational benefits.

C.6.3 Emission

Transmission to the home is subject to low bit-rate limitations and likely to be MPEG-2 MP@ML, probably limited to less than 8 Mb/s but certainly less than 15 Mb/s.

Insertion of local content may be required in some circumstances through the use of compressed stream "splicing."

C.6.4 Packaged media distribution

Distribution of content to the home is, like Emission, subject to low bit-rate limitations. A major difference, however, is likely to be the use of the VBR technique and a single channel output.

Insertion of local content will not be required, but provision for interactive branching within the stored content will, in some cases, be necessary.

C.7 Archiving

C.7.1 On-line archiving

On-line archives will generally directly record compressed bit streams to avoid the concatenation effects of another compression system. The archive may also be associated with highly compressed browse mode images and metadata to aid recovery of archive content. The quality level of the

browse mode images is only required to support picture recognition, with no expectation that these pictures will be used for any other purpose.

Metadata and browse mode images will normally be located on the same storage device for rapid access to the content. Full editing capability should be possible with on-line archive content.

C.7.2 Near-line archiving

A near-line archive is a mid-way archive containing copies of the content and metadata. Typically, browse mode images and metadata will still be stored in the on-line archive for rapid access whereas content will be stored off-line on a remote server. Full editing capability of near-line archive content is still possible.

C.7.3 Deep / long-term archiving

In a deep archive, content and all associated metadata will be stored in the archive, although only the metadata and browse mode images may be readily accessed for archive browsing. Depending on the deep archive requirements, the content may be subjected to a further compression process such as MPEG-2 MP@ML using a low bit rate.