VIDEO COMMUNICATION POLICY AT CERN

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Abstract
Many video images are transmitted around the CERN site. The main sources of these images are the beam observation cameras in the accelerators, site and machine access control cameras, and "teletext" pages showing various information such as machine status. Other images transmitted around the site include broadcasts of important meetings between conference rooms. Many methods of transmission and distribution of these images are in use. Some of the systems in use date from the very early days of the laboratory, whereas the newest systems use the latest technology. This paper will give an overview of the systems in use at CERN today, and present different options for rationalisation.

1. INTRODUCTION

Video communication at CERN consists of three phases: generation of the image; transport of the image across the site; and distribution and display of the image. A variety of transmission and distribution techniques are currently in use, and the time is now ripe to consider options for the future.

This paper represents a first evaluation of the existing systems at CERN and presents some of the possible technical options for the future. However, a Working Group on Video has recently been set up to examine the issues in more detail during 1998.

2. SOURCES OF VIDEO SIGNALS

2.1 Amphitheatre and Conference Room connections

The various auditoria and conference rooms can be interconnected for video and audio, to enable presentations and seminars to be distributed across the site.

These connections have to be of high quality. However, in terms of numbers of sources, the requirement is quite modest. The transmission of these signals is generally done using baseband, with repeaters if necessary.

2.2 Access Control

Video images are generated by access control stations for site and machine access. Each site entrance on the Meyrin and Prevessin sites as well as SPS and LEP remote sites are equipped with television cameras. There are more than 100 signals generated for site and machine access. They are transmitted by baseband with repeaters if necessary. Some signals are transmitted by multiplexed FM over optical fibre.

2.3 Beam Instrumentation

Beam Instrumentation systems provide by far the largest number of television signals at CERN. Beam observation cameras provide essential diagnostic information for the accelerator specialists. The approximate number of signals generated are:

- for the PS: 120
- for the SPS: 45
- for LEP: 21

The required quality for beam instrumentation purposes is not high: colour is not required, and medium definition will suffice. However, slow scan techniques are not acceptable, as the refresh rate must be at least 20Hz.

As well as beam observation cameras there are a significant number of other beam instrumentation video signals which have to be collected. These are mainly images from the screens of specialized instruments such as spectrum analysers. The image quality required is similar to that of the beam observation cameras, in particular as far as refresh rates are concerned.

2.4 Machine Status

There are a considerable number of status pages generated, particularly for the accelerators. These are low-definition, and there is little movement (typically a display will show beam energy ramping over a machine cycle). Many of the status pages are generated using Teletext techniques, and only carry text and semi-graphical characters.

3. TRANSMISSION

The two principal techniques used to transmit video images across the considerable distances over the CERN sites are baseband and multiplexed FM over optical fibre.

Baseband transmission requires a physical link (usually a twisted pair cable) for each signal transmitted. As video signals require a bandwidth of several megahertz the distance which can be covered using this technique is very limited, and so repeaters are frequently required, which increases the complexity of the system.

Another system which is in widespread use involves frequency modulation the video signal, and multiplexing it with other video signals on a single optical fibre. This system is particularly used over the longer distances between LEP sites. The system provides reliable and cost-effective transport of video images without the need for repeaters. However, the system adopted is proprietary, and is no longer manufactured.

4. DISTRIBUTION

Other than directly connected television monitors the normal method of distribution of video images at CERN is using broadband CATV techniques.

Broadband CATV is in widespread use for cable television networks for appartments and housing complexes. A large variety of equipment is available from many manufacturers. One advantage of broadband distribution is that it is possible to use standard television monitors, which are cheap.

5. NEW TECHNOLOGIES

5.1 Packet Video

The widespread use of packet-switching data networks on for both on-site communications (Local Area Networks) and worldwide communications has triggered great interest in the use of these networks for multimedia. Whilst the protocols used by these networks were originally designed for pure data communication, it is of course possible to transfer digitized voice and video across them.

The problem with using packet-switched networks for video and audio is that there is no guarantee of bandwidth. Thus the quality of transmission obtained is very variable, and depends on the loading of all parts of the network. It is not therefore possible to give a guaranteed quality of service, unless a specific "virtual network" is dedicated to multimedia traffic.

5.2 Videoconferencing over ISDN

The Integrated Services Digital Network (ISDN) philosophy is now being adopted by Public Network operators around the world. ISDN brings a digital connection through the existing telephone network directly to the subscriber. In practical terms this means that a subscriber has available a reliable 64kbit/sec or 128kbit/sec connection to the telephone exchange, without the need for a modem.

These "circuit-switched" data connections are adequate to transmit compressed video images together with audio. The widespread availability of ISDN connections has led to their use for videoconferencing purposes. Various technical standards have been developed by ITU-T for videoconferencing. In particular the H.261 Recommendation has found widespread acceptance, and equipment (known as CODECs) is available from many manufacturers to digitally encode and decode video and audio signals according to this Recommendation.

Other video compression techniques are becoming available, based on the MPEG, MPEG2, and Motion JPEG standards.

5.3 Digital Video Broadcasting

Advances in predictive coding technology (as used for the videoconference codecs) and improvements in modulation techniques have, in the last few years, made possible totally digital transmission and distribution of television images for the mass market.

Spearheaded by the European Broadcasting Union, standards have been devised for digital television. Several data rates are recommended, for different quality of image. The lowest quality is similar to that of videoconference systems, and is probably adequate for telesurveillance. The highest quality permits the transmission of full colour high-definition TV: this is probably not necessary at CERN.

Many broadcasters in Europe, North America, and Asia have announced their intention to transmit images digitally. Indeed, many satellite services are already digital, and terrestrial systems will start operating shortly. The expectation is, therefore, that a wide range of equipment will become available, at prices aimed at the mass market.

5.4 Asynchronous Transfer Mode

A very interesting new technology which could be used for the digital transmission of video images is Asynchronous Transfer Mode (ATM). In fact, ATM was originally conceived for that very purpose. ATM is a fast packet switching system, where the packets, or cells, have a fixed size of 53 bytes. This small cell size means that ATM has the advantages of both packet and circuit switched systems. Additionally, data rates are not fixed, and can be selected according to the application. This is particularly useful when it is required to transmit bursty traffic: exactly the characteristics of compressed video.

It is very likely that an ATM "backbone" will be implemented at CERN for the interconnection of LAN routers, as well as, possibly, for the links between switching nodes of the PABX. It will therefore be interesting to evaluate the implications of using the same technology for video transmission.

6. CONCLUSION

The video transmission and distribution systems currently in place at CERN need to be replaced. The development of digital technology may well provide the opportunity to implement this replacement is a consistent and rational way.

ACKNOWLEDGEMENTS

The author would like to thank D. Bakker, M. Boffard, B. Frammery, J.-J. Gottraux, C. Jacot, and R.Jung for their valuable discussions.

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