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Main functionalities and basic requirements
for Multipoint Control Units (MCUs)

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Foreword

This European Telecommunication Standard has been prepared by the Terminal Equipment (TE) Technical Committee of the European Telecommunications Standards Institute (ETSI).

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1 Scope

This ETS specifies the functional requirements applicable to a Multipoint Control Unit (MCU), or a set of interconnected MCUs, which allows several audiovisual terminals to communicate simultaneously using single or multiple digital channels up to 1 920 kbit/s when interconnected through the pan-European Integrated Services Digital Network (ISDN).

This ETS specifies the basic in-band signalling procedures to be supported to control the operation of MCU and audiovisual terminals involved in a simple multipoint communication or a basic video/ audiographic conference as specified in other standards.

This ETS includes an overall description of the basic and optional functionalities of a MCU, and lists the related requirements.

Annex A (informative) describes the various requirements which apply to audiovisual terminals in order to ensure their capability to take part in multipoint communications.

A MCU with any interface connected to the ISDN via a Channel Aggregation Unit (CAU) and/or special interface adapters may be used for multipoint communication when the composite equipment complies with all requirements specified in this ETS. However, the various related pieces of equipment are outside the scope of this ETS.

A MCU may establish conferences which include not only audiovisual terminals connected through an ISDN, but also some audiovisual terminals directly linked through digital leased lines.

A MCU may set up a conference where the connected terminals include not only videoconference and videotelephony terminals but also Audiographic conference, 7 kHz telephony or 3,1 kHz telephony terminals. The description of protocols and requirements is limited to the basic multipoint communication established between various terminals supporting 3,1 kHz telephony, 7 kHz telephony, or the Videotelephony teleservice. The protocols and requirements necessary to support more sophisticated services, such as Videoconference, Audiographic conference, or applications based on data transmission are not considered here.

> NOTE 1: The T.120 series of ITU-T Recommendations presently developed by ITU-T SG 8 should be used to support such enhanced functionalities.
>
> Use of the protocol specified in ITU-T Recommendation H.243 to support these functionalities should be precluded since it would result in incompatibilities between MCUs and/or terminals.
>
> NOTE 2: In the case of interworking with Public Switched Telephone Network (PSTN) or mobile telephony terminals, echoes and/or transmission delays can degrade the audio communication quality to an unacceptable level.

A MCU may be owned either by a public service provider or by a private customer. In the latter case the equipment is part of a Private Telephone Network.

The D-channel signalling protocol used to set up, modify and clear a multipoint communication is outside the scope of this ETS.

On line procedure and/or protocol to be used by an end user to require, modify or cancel a conference reservation is outside the scope of this ETS.

Implementation of the T.120 series of ITU-T Recommendations for the support of the enhanced functions associated to various options of the videoconference service (e.g. Conference control, multipoint data communication service) is outside the scope of this ETS.

Conformance to this ETS will be demonstrated by checking that all mandatory functional requirements are supported during execution of a test suite which is specified in other ETSs.

2 Normative references

This ETS incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications listed hereafter. For dated references, subsequent amendments to, or revisions of any of these publications apply to this ETS only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

[1]   ETS 300 144: "Integrated Services Digital Network (ISDN); Audiovisual services; Frame structure for a 64 kbit/s to 1 920 kbit/s channel and associated syntax for inband signalling".

[2]   ITU-T Recommendation G. 728 (1993): "Coding of speech at 16 kbit/s using low-delay code excited linear prediction".

[3]   CCITT Recommendation G. 711 (1988): "Pulse code modulation (PCM) of voice frequencies".

[4]   CCITT Recommendation G. 722 (1988): "7 kHz audio-coding within 64 kbit/s".

[5]   ETS 300 012: "Integrated Services Digital Network (ISDN); Basic user-network interface; Layer 1 specification and test principles".

[6]   ETS 300 011: "Integrated Services Digital Network (ISDN); Primary rate user-network interface; Layer 1 specification and test principles".

[7]   ETS 300 290: "Business TeleCommunications (BTC); 64 kbit/s digital unrestricted leased line with octet integrity (D64U); Terminal equipment interface".

[8]   ETS 300 248: "Business Telecommunications (BT); Open Network Provision (ONP) technical requirements; 2 048 kbit/s unstructured leased line (D2048U); Terminal equipment interface".

[9]   ETS 300 420: "Business TeleCommunications (BTC); 2 048 kbit/s structured leased line (D2048S); Terminal equipment interface".

[10]   ETS 300 102-1: "Integrated Services Digital Network (ISDN); User-network interface layer 3; Specifications for basic call control".

[11]   ETS 300 267: "Integrated Services Digital Network (ISDN); Telephony 7 kHz and videotelephony teleservices; Digital Subscriber Signalling System No. one (DSS1) protocol".

[12]   ETS 300 164: "Integrated Services Digital Network (ISDN); Meet-Me Conference (MMC) supplementary service; Service description".

[13]   ETS 300 185: "Integrated Services Digital Network (ISDN); Conference call add-on (CONF) supplementary service; Digital Subscriber Signalling System No. one (DSS1) protocol".

[14]   ETS 300 143: "Integrated Services Digital Network (ISDN); Audiovisual services; Inband signalling procedures for audiovisual terminals using digital channels up to 2 048 kbit/s".

[15]   ETS 300 145: "Integrated Services Digital Network (ISDN); Audiovisual services; Videotelephone systems and terminal equipment operating on one or two 64 kbit/s channels".

[16]   ITU-T Recommendation H. 261: "Video codec for audiovisual services at p x 64 kbit/s".

3 Definitions

For the purposes of this ETS, the following definitions apply:

Conference control: The capability conferred to one terminal to control operation of the MCU. This function requires a specially designed terminal. The terminal user may be the actual chairman of the meeting or the conference controller.

Directly connected terminal or **Local terminal**: A terminal connected to a given MCU (this wording should be used only in case of multiple MCU configuration).

Master MCU: The MCU selected to control the system operation in case of multiple MCU configuration.

Multipoint Control Unit (**MCU)**: A functional entity which is used to establish a multipoint communication between several audiovisual (or audio only) terminals. A MCU may be owned by the customer (and located in its premises) or may be offered by a service provider/network operator.

MCU Port: The bi-directional access point of the digital link established between a terminal (or another MCU) and a MCU. It is a logical entity; a port may eventually require several MCU-Network physical interfaces, but several ports may also share a MCU-Network physical interface.

Primary Port: A MCU Port where the connected terminal can support the SCM.

Secondary Port: A MCU Port where the connected terminal has a lower capability than the SCM.

Selected Communication Mode (**SCM)**: Common operating mode of most terminals during the conference. It defines symmetrical rates for audio, video and any data path.

token: A virtual token which may be allocated by a controlling entity (MCU or Conference-control terminal) to confer, to a requesting terminal, authorisation to initiate a special activity (e.g. video broadcast, data transmission) which otherwise would be in conflict with normal or similar activities of other terminals. Such a token may be allocated or "passed" successively from one terminal to another.

4 Abbreviations

For the purposes of this ETS, the following abbreviations apply:

APU	Audio Processor Unit
BAS	Bit-rate Allocation Signal
C&I	Control and Indication
cap-set	capability set
CAU	Channel Aggregation Unit
CLIP	Calling Line Identification Presentation
CPU	Control Processor Unit
DPU	Data Processor Unit
ECS	Encryption Control Signal
FAS	Frame Alignment Signal
ISDN	Integrated Services Digital Network
MBE	Multiple Byte Extension (BAS codes)
MCS	Multipoint Communication Service
MCU	Multipoint Control Unit
MDU	Multiplexer/Demultiplexer Unit
MLP	Logical data sub-channel which may contain various data protocols (also referred to as Multi-Layer Protocol in ETS 300 144 [1])
NIU	Network Interface Unit
OA&MT	Operation, Administration and Maintenance Terminal
ONP	Open Network Provision
PIN	Personal Identification Number
PSTN	Public Switched (analogue) Telephone Network
SBE	Single Byte Extension (BAS codes)
SCM	Selected Communication Mode
SCM-cap	SCM capability set

VPU   Video Processor Unit

> NOTE: A complementary list of abbreviations used for C&I (typed in bold characters) can be found in tables 5 and A.2.

5   Functional requirements for a MCU

5.1   Basic functions

A MCU includes several types of functional entities. An overall description is given by the schematic of figure 1 (see subclause 5.1.5). The various functional entities are listed and briefly described below. The two first types shall be provided for every individual port, while the others are common to all ports involved in a multipoint communication (conference).

> NOTE: There is no particular limit set to the maximum number of ports involved in a conference, however it is practically limited, taking into account cost, set-up difficulty and audio performance degradation (noise).
>
> A same piece of equipment called a MCU, may simultaneously handle several independent videoconferences.

5.1.1   Network Interface Unit (NIU)

The Network Interface Unit (NIU), supported by a local call control facility, has two basic tasks:

-      the establishment and release of the digital link related to the port;

-      the adaptation of the composite signal (audio + video + signalling + etc.) to the ISDN interface.

> NOTE: The network access may use an external standard interface adapter.

5.1.2   Multiplexer/Demultiplexer Unit (MDU)

The Multiplexer/Demultiplexer Unit (MDU) performs the following tasks:

-      the generation/recovery of in-band frame and multiframe synchronisation signals;

-      the buffering and ordering of audio, video, data and in-band signalling signals;

-      the transmission/reception of Bit-rate Allocation Signal (BAS) codes;

-      the transmission/reception of optional data sub-channel(s).

This unit is also used to split/aggregate several "64 kbit/s channels" which may be necessary for a given port, when this is required by the selected transfer rate capability.

> NOTE: Splitting/aggregation may be achieved in an external piece of equipment.

5.1.3 Audio Processor Unit (APU)

The Audio Processor Unit (APU) receives audio inputs from all demultiplexers and generates the same number of audio outputs sent to the multiplexers. The generation of output signals may use one of several techniques:

a) audio mixing - the signal sent to each terminal is the linear sum of the audio signals delivered by the other terminals;

b) audio switching - the signal sent to a conferee is either the largest audio input signal or is directly selected according to the controlled operating mode. In any case no signal is returned to the speaker; the switching shall be performed smoothly and without additional noise.

NOTE: In both cases audio signals with a level lower than an adjustable threshold may be suppressed in order to avoid the addition of useless noises/echoes.

A small time delay (Θ_a) may be incorporated into the automatic switching to prevent its excessively frequent activation by inadvertent noises (coughing, knocking a microphone, etc.).

5.1.4 Video Processor Unit (VPU)

The Video Processor Unit (VPU) receives video signals from all demultiplexers and generates video signals sent to the multiplexers. The generation of output signals is generally based on switching techniques:

a) the signal broadcast to conferees is the picture of the current speaker (largest audio input signal). In this case the signal sent to the current speaker is the signal received from the previous speaker;

b) the signal sent to the conferees is selected according to a special operating mode:

- a terminal requires broadcasting its video to all other conferees (one at a time);

- the MCU itself chooses which video shall be broadcast (cf. subclause 6.1.6.2).

NOTE: In case of automatic video switching, another time constant (Θ_v) may be used to prevent useless activation resulting from a short voice burst.

The MCU should be designed in order to preserve the audio/video alignment as provided by terminals.

5.1.5 Control Processor Unit (CPU)

The Control Processor Unit (CPU) controls set up and release of the various digital links. In the case of ports connected to an ISDN, it provides for co-ordinated set-up and release of the initial and additional "channels".

The CPU exchanges information with connected terminals by sending and receiving the BAS codes transmitted through the in-band signalling procedures.

After an initial capability exchange sequence, the CPU defines the SCM and controls the various entities (NIU, MDU, APU, VPU and DPU) according to:

- capabilities declared by the audiovisual terminals;

- MCU configuration and management data.

After exchange of Controls and Indications (C&I), the CPU routes the various internal signals.
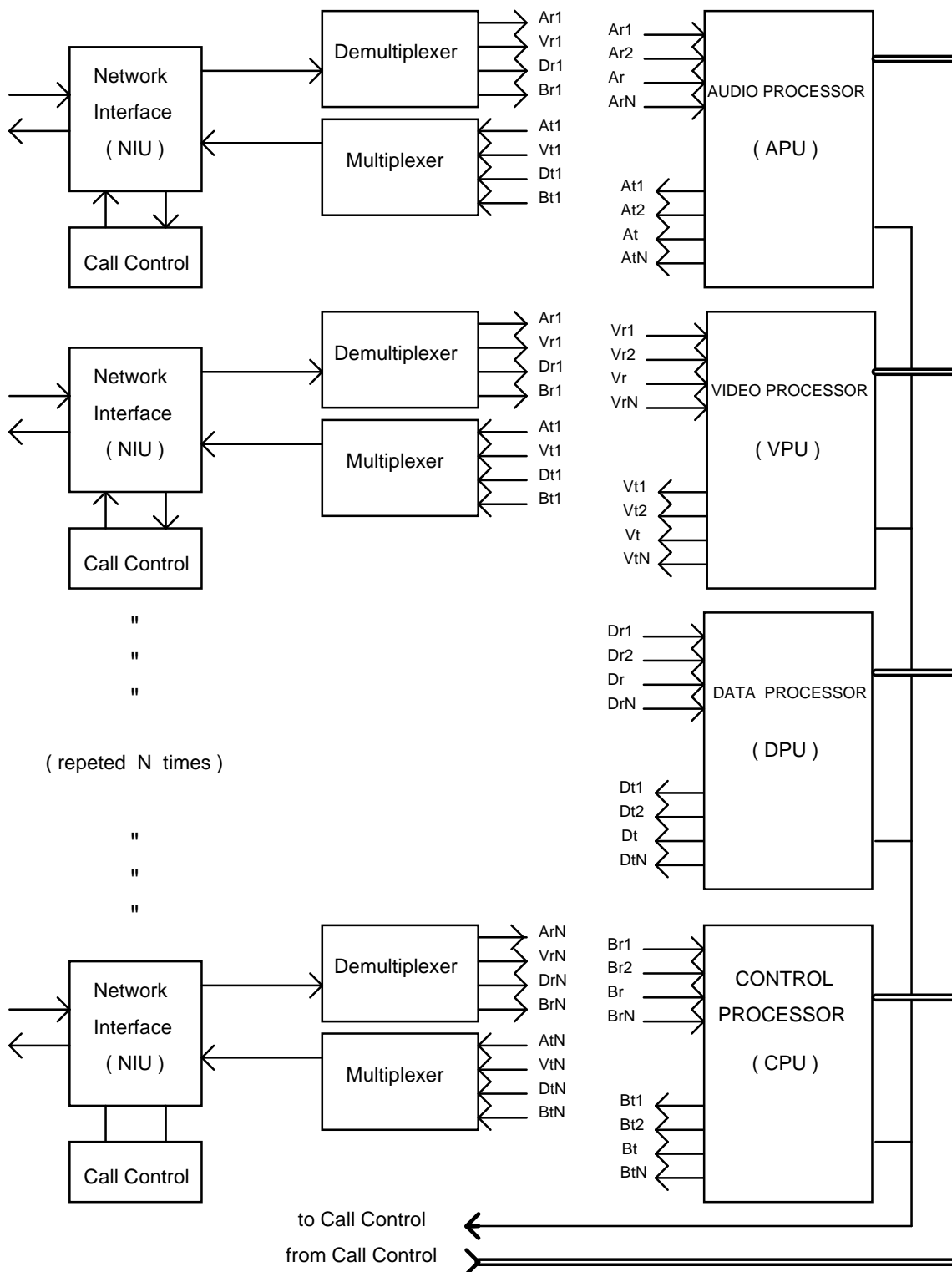
Figure 1: Schematic of a Multipoint Control Unit

5.2 Optional functions

A wide variety of MCUs may be developed according to the various options which could be provided. In order to identify, in subclause 5.3, the minimum requirements applicable to a "basic" MCU, a non-exhaustive list of optional functions is presented below.

Some optional functions require related enhanced functions of connected terminals (e.g. terminal used for Conference control), however terminals having no such enhancements may take part in a videoconference without misoperation (cf. annex A).

Some optional functions are not independent since one shall be supported to allow implementation of another one (see "bound options" in table 1, subclause 5.3.2).

When an option described in this ETS is declared by a manufacturer or service provider, the related protocol procedures shall conform to the requirements specified in clause 6.

5.2.1 Additional audio processing

Additional functions could be:

a)   provision of tones and/or announcements during conference set-up;
b)   total control of individual audio source and destination.

5.2.2 Additional video processing

In addition to the basic switching functions listed in subclause 5.1.4, a MCU may provide:

a)   video mixing: the signal sent to all conferees results from spatially multiplexing the images sent by the other terminals into a single composite image in a "split screen" format;
b)   total control of individual video source and destination;
c)   provision of visual information on call and/or terminal states.

5.2.3 Additional call processing

To be able to interwork with audiovisual terminals, which may offer various interfaces and/or transfer rate capabilities, a MCU may provide:

a)   internal splitting/aggregation of the various "64 kbit/s channels" involved in a MCU-terminal link;
b)   compatibility with multiple channel terminals;
c)   compatibility with mixed single and multiple channel terminals (SM comp capability);
d)   compatibility with remote terminals connected to restricted networks;
e)   compatibility with 3 kHz, 4 kHz and/or 7 kHz telephony terminals.

Conference set-up mode results from permanent, reserved and on-demand connections. In the latter case the MCU may offer several alternative procedures:

f)   "Meet-me conference" using a MCU ISDN destination number;
g)   "Meet-me conference" using a conference ISDN destination number;
h)   "Dial out conference" with previous registration of conferee ISDN numbers;
i)   "Mixed mode (Dial out and Meet-me) conference".

During the conference, a MCU may also offer additional facilities related to call control such as:

j)   addition of a new conferee (add on conference requiring new dialling);
k)   exclusion of a terminal (connection is released).

5.2.4 Management of the SCM

At least one of the following solutions shall be available to determine the Communication Mode and shall be clearly indicated to user by manufacturer and/or service provider:

a)   the SCM is fixed, it results from the MCU definition and manufacture;

b)   the SCM is fixed, it results from a previous arrangement with the service provider at the time of conference booking;

c)   the SCM is set up according to a Multi-Layer Protocol (MLP) based procedure;

d)   the SCM is selected automatically according to an identified algorithm (e.g.):

-    highest common mode of audiovisual terminals;
-    based on capabilities of the chair-control terminal;
-    based on an adjustable threshold;
-    etc.

NOTE: When the SCM is fixed, any terminal with a lower capability may be rejected; otherwise, it is considered as a secondary terminal (subclause 6.1.1).

5.2.5 Alternative conference management modes

A MCU shall at least provide the unconducted mode, where switching functions are performed automatically, and result in selection and transmission of the current speaker image (subclause 5.1.4).

In addition, it may also provide conference control procedures.

When the conference control facility is declared, the following functions shall be provided:

a)   claim, assignment of chair-control token;
b)   withdrawal of chair-control token (return to voice activation mode);
c)   indication of connected terminals;
d)   indication of selected terminal for video broadcast;
e)   indication of terminals asking the floor;
f)   selection of a terminal for video broadcast;
g)   addition/drop of a terminal;
h)   withdrawal of data token (cf. subclause 5.2.7);
i)   release of the complete conference;

however, further possible options may be offered:

j)   selection of video signal sent to the terminal having the Chair-control;
k)   separate interconnection of two terminals for private consultation.

5.2.6 Identification of connected terminals

Identification of connected terminals by numbering procedures, though optional, should be required for most of the functions available under the conference control provisions. Terminal identification may also be used in order to associate incoming calls (for additional channels) to originating terminals. This is specially useful in case of "Meet-me conference" (cf. subclause 5.2.3) using the same ISDN destination number (allocated either to the MCU or to the conference).

5.2.7 Data transmission and/or broadcast functions

A Data Processor Unit (DPU), as shown in figure 1, shall support data transmission. The data shall be transmitted/broadcast according to the capability of the connected terminals.

When a terminal has not declared the related capability, it does not receive the data and, in addition, does not receive video, since it cannot support the multiplexed rates effective between the MCU and those terminals exchanging data (it is reduced to "secondary" status).

NOTE: An option could be to continue video exchange between secondary terminals; but a better solution is the implementation by terminals of the "Dummy data" capability (cf. annex A).

When the Data transmission/broadcast option is declared, the following functions shall be provided independently for any data sub-channel:

a) claim, assignment of Data token;
b) withdrawal of Data token;
c) opening/closing of a data sub-channel;
d) changing rate of a data channel;
e) closing of data channel on time out (no token claim).

5.2.8 Identification of token assignment

A MCU may be able to identify, by their allocated number, terminals to which either the Conference control, or Data tokens have been assigned; then, it shall send this information to any requesting terminal.

5.2.9 Transmission of additional information

Additional information may be transmitted between the MCU and terminals in order to make the Conference control terminal user friendly. It can consist of supplementary identity information (e.g. user/company names, location/country) or be oriented to a better conference management (e.g. conference end-time reminder).

5.2.10 Multiple MCU configurations

The use of several MCUs for a videoconference may be considered when special requirements result from:

- the number of terminals;
- the location of terminals;
- the digital links availability (leased lines and public ISDN accesses).

The resulting configurations include:

- MCU star: two or more MCUs, connected to a central one, define a second order hierarchy (cf. figure 2, a);

- Dumb-bell: two interconnected MCUs gathering terminals at both ends (cf. figure 2, b) but may extend to higher order configurations.
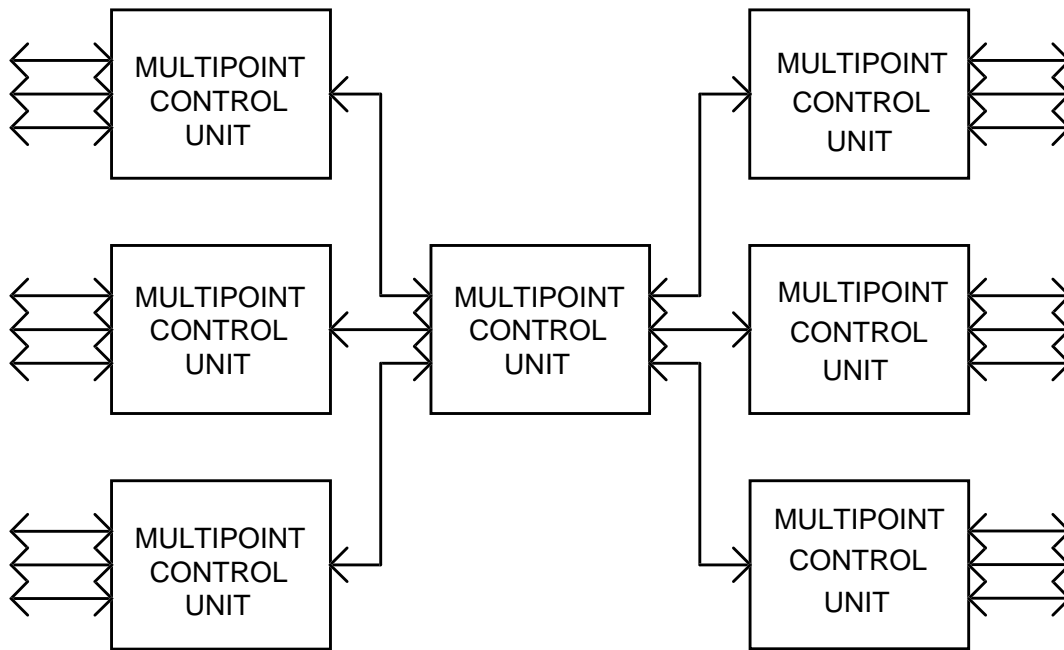
a) "Star" configuration
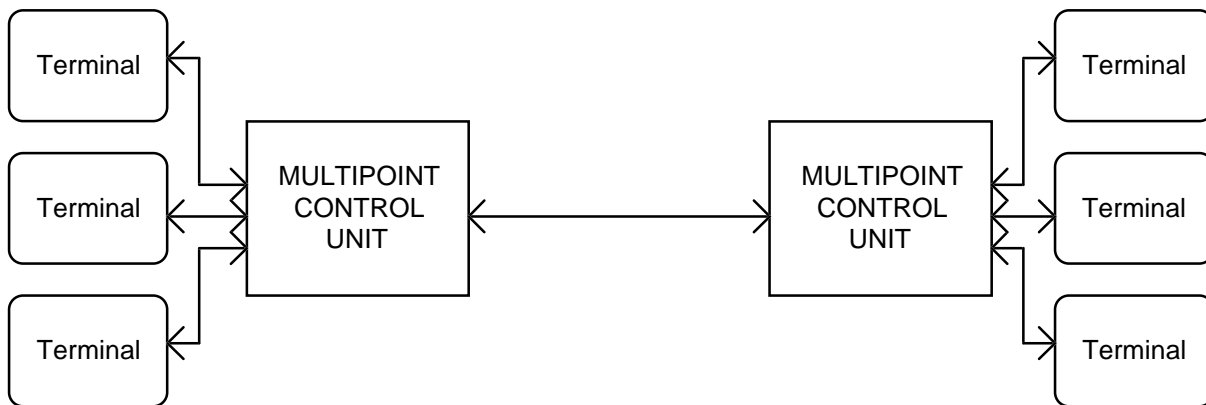
b) "Dumb bell" configuration

NOTE: In most cases, a user cannot choose the video sent to his terminal when the source is not connected to the local MCU.

Figure 2: Multiple MCU configurations

In the case of a multiple MCU configuration, the following functions may be provided:

a) master/slave designation before the conference;
b) automatic choice of a master in case of Dumb-bell configuration.

5.2.11 Off-line or on-line conference administration

The MCU may offer additional functions related to videoconference booking and scheduling. They are outside the scope of this ETS but have an impact on the way a MCU reacts to some stimulation during its test. They could include, for example, registration of various parameters which are used later to set up a videoconference:

a)   user data such as name, site, ISDN number, password;
b)   terminal characteristics: capabilities and special facilities;
c)   day, time and duration;
d)   conference modes (initial mode and allowed changes);
e)   Conference control (initial and alternative possibilities);
f)   Data token allocation (initial and further allowed assignments).

5.2.12 Security measures

A MCU may combine D-Channel and in-band procedures to identify end points and, when possible, to authenticate conferees by exchanging passwords or Personal Identification Numbers (PINs).

5.2.13 Maintenance

A MCU may offer many different maintenance functions including self tests and fault diagnostics; they are outside the scope of this ETS, however when these functions rely on local or remote loop backs (in the connected terminals) performed at different points, they shall conform to related standardized protocol procedures.

Care should be taken to avoid automatic testing that disturbs the normal MCU operation.

5.2.14 Operation Administration and Maintenance Terminal (OA&MT)

Definition, functions and interface of the OA&MT are outside the scope of this ETS.

5.3 Various types of MCU - minimum functional requirements

5.3.1 Different classes of MCU

Given the wide range of possible capabilities and options, it is appropriate, for convenience and clarity, to identify several classes of MCU which can be referred to.

A definition of seven MCU classes is given below.

Class 1   addresses equipment especially designed to establish an audiovisual conference where participants use 1B videotelephony terminals (with audio coding according to ITU-T Recommendation G.728 [2]) and 3,1 kHz telephony terminals.

Class 2   includes MCU which can establish conferences between participants using 2B videotelephony terminals and 3,1 kHz or 7 kHz telephony terminals.

Class 2d   this MCU has the same definition as above but, in addition, supports data transmission/broadcast and/or data applications.

Class 3   addresses MCUs which aim at multipoint meetings where every site has terminals offering an enhanced picture quality resulting from a higher transfer rate (3B to 6B).

Class 3d   same as above with the data functionalities.

Class 4 includes MCU which can be used to established videoconferences with high quality pictures established between specially equipped rooms, and where additional facilities such as Conference-control, though optional, are recommended.

Class 4d same as above with the data functionalities.

5.3.2 Minimum functional requirements for every class of MCU

Table 1 lists the various attributes which are used to characterize a MCU.

The minimum requirements are listed as mandatory attributes (M).

The support of some functional attributes identified (R) are recommended.

The attributes marked (∗) identify options which may be supported independently.

Some attributes marked (n) relate to "bound" options, which cannot be reasonably provided separately; they are defining an option package.

When several attributes are marked (C), this means that at least one of these functionalities shall be chosen and supported by a MCU.

When there is no entry for one attribute in a Class column, this means that it is inopportune or useless.

> NOTE: Manufacturers may include, in one product, one or more of these "classes". They may also provide additional options which then conform to related definitions and standardized protocol implementation, but the behaviour when used with other equipment might be less predictable or lead to man-machine interface problems.

Table 1: MCU classes and related requirements

N°	Attributes	Values	Reference	Requirements vs MCU class 1	2	2d	3	3d	4	4d
1	Minimum number of ports	4 to 8	5.3.1, 5.3 2	4	4	4	4	4	4	4
2	Type of network interface	ISDN - Basic Access		C	C	C	*	*	M	M
		ISDN - Primary Rate		C	C	C	*	*	M	M
		Leased line G.703		*	*	*	*	*	*	*
		Leased line V.35		*	*	*	*	*	*	*
3	Minimum transfer rate capability at every port	64 kbit/s or 1B		M						
		128 kbit/s or 2 B		*	M	M				
		384 kbit/s or 6 B			*	*	M	M		
		> 384 kbit/s					*	*	M	M
4	Audio processor mode	audio mixing	5.1.3 a	C	M	M	M	M	M	M
		automatic switching	5.1.3 b	C	*	*	*	*	*	*
		controlled switching	5.1.3 b				*	*	*	*
		tones/announcements	5.2.1 a				*	*	R	R
		total control	5.2.1 b		*	*	*	*	*	*
5	Audio coding algorithm	G.711 [3]+ G.728 [2]		M						
		G.711 [3] + G.722 [4]			M	M	M	M	M	M
		G.711 [3] + G.722 [4] + G.728 [2]		*	*	*	*	*		
6	Video processor mode	automatic switching	5.1.4 a	M	M	M	M	M	M	M
		controlled switching	5.1.4 b		*		*	*	*	*
		mixed video (split screen)	5.2.2 a				*	*	*	*
		total control	5.2.2 b						*	*
7	Channel aggregation (more than 2 B-channels)	Internal aggregation	5.2.3 a		R	R	R	R	R	R
		"SM comp" capability	5.2.3 b/c				R	R	R	R
		Use of terminal identity	5.2.6				*(1)	*(1)	*(1)	*(1)
8	Set up mode/Call control	Meet-me conference	5.2.3 e/f	*	*	*	C	C	C	C
		Dial out conference	5.2.3 g				C	C	C	C
		New conferee addition	5.2.3 h				*	*	*	*
		Exclusion of conferee	5.2.3 i				*	*	*	*
		Restricted network comp.	5.2.3 d	*	*	*	*	*	*	*
9	Selected communication mode	Fixed by manufacturer	5.2.4 a	C	C	C	C			
		Programmable	5.2.4 b/c	C	C	C	C	C	C	C
		Automatic selection	5.2.4 d	C	C	C	C	C	C	C
		Telephony terminals accepted secondary terminals)	6.1.1	M	*	*	*	*	*	*
10	Support of loop backs	Local loops (in MCU)	6.3				*	*	*	*
		Remote (in terminals)	6.3				*	*	*	*
11	Support of Multiple MCUs configuration	Master/Slave pre-set	5.2.10 a		M	M	M	M	M	M
		Auto selection (for 2)	5.2.10 b				*	*	R	R
12	Conference control facility	Facility support			*	*	R	R	R	R
							*	*		
13	Data transmission/broadcast capability	Support of data facilities	5.2.7			M*		M*		M*
14	Management of various additional information concerning: user, call, token	Support of various individual facility	5.2.5 to 5.2.9		*	*	*	*	R	R
					*	*	*	*	*	*
15	Terminal identification						*(1)	*(1)	M	M
16	MBE capability					*	*	*	*	*

5.4 Technical requirements

5.4.1 General requirements

A MCU, which belongs to a given class, shall support the mandatory attributes listed in table 1 and include the basic functional entities described in subclause 5.1. When an option is declared, it shall be required to offer the various facilities considered as mandatory in the description of subclause 5.2.

5.4.2 Requirements applicable to individual functions

Network interface: when a MCU has an ISDN interface, it shall conform either to ETS 300 012 [5] (basic access) or 300 011 [6] (primary rate).

NOTE: If the ISDN access is provided by separate piece of equipment (e.g. adapter, CAU, it is still considered as part of the MCU, it provides the same functions and conforms to the same call control requirements. The interface between the two pieces of equipment is outside the scope of this ETS.

When a MCU is designed to use several ports with more than two B-channels, an ISDN primary rate interface is recommended.

When a MCU provides access to Open Network Provision (ONP) digital leased lines, the interface shall conform to ETS 300 290 [7] (64 kbit/s) or ETS 300 248 [8] or ETS 300 420 [9] (2 048 kbit/s). Other interfaces which may be provided are outside the scope of this ETS.

Audio mixing/switching: audio mixing/switching shall not lead to a noticeable degradation of speech transmission characteristics (signal/noise ratio) compared to those resulting from the successive codings and decodings necessary to achieve the linear addition of voice signals. Speech encoding, when used, shall conform to related CCITT Recommendations G.711 [3] and G.722 [4], or ITU-T Recommendation G.728 [2]. Switching shall be performed smoothly in order to avoid addition of any spurious noise.

In the case of interworking with networks and/or terminals which may cause a higher echo level (e.g. PSTN analogue telephones) and/or longer echo delay (e.g. GSM terminals), care should be taken to keep the audio transmission to an acceptable level of quality. This may require implementation in the MCU of an echo cancelling device.

Video switching: care shall be taken to avoid that switching between different video sources occurs too frequently.

Call control: call set up and/or release procedures, and D-channel signalling messages shall conform to ETS 300 102-1 [10], and ETS 300 267 [11]. The support of fall back procedures and several teleservices shall be in accordance with the optional support of secondary terminals. When the MCU supports supplementary services, it shall use relevant adapted standard procedures and protocols (e.g. ETS 300 164 [12] or ETS 300 185 [13]).

Signal Multiplexing and Framing: audio, video and optional data signals shall be multiplexed with Frame Alignment Signal (FAS) and BAS in a frame structure according to ETS 300 144 [1].

In-band signalling: in-band signalling procedures shall conform to the various requirements of ETS 300 143 [14] and of clauses 6 and 7 of this ETS. Frame synchronous Control and Indication (C&I) codes shall conform to the description and requirements of ETS 300 144 [1]. Protocols necessary to support enhanced functionalities are not included in this ETS.

Data broadcast: between the times a data sub-channel is opened and the data channel is activated, the MCU shall fill idle bits with binary "1s".

6 Special procedures for multipoint communications

In addition to in-band signalling procedures specified in ETS 300 143 [14], MCUs and terminals supporting basic multipoint communications, shall conform to the requirements specified below.

6.1 Basic procedures

6.1.1 Initialisation procedures

Initialisation procedures allow the communication to be established between the terminals according to the appropriate SCM.

NOTE 1:   The SCM is either fixed or results from encountered terminal capabilities as described in subclause 5.2.4.

A MCU may successively declare different capabilities according to those declared by newly connected terminals. It may, for instance, initially declare 6 B-channel and CIF capability and later accept 2 B-channel and QCIF for final SCM capability, as this one is supported by the majority of connected terminals.

During the initial phases the MCU may, as an option, deliver an audio announcement indicating that a conference is being set-up.

When a terminal is turned to secondary status or rejected, the MCU may deliver an audio announcement to the terminal in order to inform the user.

The in-band signalling procedures are similar to those described in ETS 300 143 [14] and ETS 300 145 [15] while C&I definitions and codings are specified in ETS 300 144 [1].

Table 2 describes the various steps related to the three first connected terminals with exchange of C&I symbols (**MCC**, **MIZ**, **VCU**, **VIR**). The procedures remain identical after the third terminal.

NOTE 2:   The various steps are listed in logical order, but may be interleaved according to call set-up time and unpredictable delay for in-band signalling transmission.

Table 2 assumes, for simplification, that terminals 1, 2 and 3 support the proposed SCM. After their connection, terminals 1 and 2 exchange their video signals; however when terminal 3 is connected, its video signal is transmitted to terminals 1 and 2, while it receives the video signal from terminal 1 (as it may result from a previous arrangement). As indicated, the MCU shall no longer forward **VIR**, as soon as more than two terminals are connected (step c'7).

When the SCM involves multiple channels, this is reflected in the transmitted MCU transfer rate capability. The video transmission from a terminal is switched on, by an appropriate command sent by the MCU, only after set-up and synchronisation of all related channels.

In the event that any connection does not reach the proper number of additional channels, the MCU may either disconnect this terminal from the conference, or downrate the port to secondary status and proceed normally with the others (steps a'1 $\rightarrow$ c'4).

When a terminal has a lower capability than the SCM, and the SCM will not be adjusted to accommodate the terminal, the MCU may either disconnect its call or assign it a secondary status sending **MIS**; then, for this terminal the participation to the conference is limited to audio.

Table 2: Initialisation procedures

Procedures	Steps	MCU	Terminal 1	Terminal 2	Terminal 3	Comments
1st TERMINAL						
Capability exchange	a1	SCM-Cap O---------->				ref. ETS 300 143 [14], subclause 6.1
	a2	Cap-set <----------O				
Mode switching (audio)	a3	Command audio mode O---------->				ref. ETS 300 145 [15], subclause 6.1
Conference indication	a4	MCC + MIZ O---------->				ref. ETS 300 144 [1], subclause 10.2.2
2nd TERMINAL						
Capability exchange	b1	SCM-Cap O--------------------------->			
	b2	Cap-set <---------------------------O			
Mode switching (audio)	b3	Command audio mode O--------------------------->			
	b4	Cancel MIZ O------------>				ref. ETS 300 144 [1], subclause 10.2.2
Mode switching (video)	a5	Command video ON O------------>			
	b5	Command video ON O--------------------------->				ref. ETS 300 145 [15], subclause 6.1
Video fast update request	a6	VCU O------------>			
	b6	VCU O--------------------------->				ref. ETS 300 144 [1], subclause 10.2.2
Forwarding VIR	a7	VIR <----------O				Special case "terminal 1 sends VIR"
	b7	VIR O--------------------------->				ref. ETS 300 144 [1], subclause 10.2.2
3rd TERMINAL						
Capability exchange	c1	SCM-Cap O-->			
	c2	Cap set <--O			
Mode switching (audio)	c3	Command audio mode O-->			
Mode switching (video)	c5	Command video ON O-->			
Video fast update request	a6	VCU O---------->			
	c6	VCU O-->			
Ignoring VIR	c'7	VIR <--O				Exceptional procedure "terminal 3 sends VIR" MCU returns VIR but does not forward VIR to connected terminals
		VIR O-->			
Secondary status assignment	a'1	SCM-Cap O---------->			
	a'2	Cap-set <----------O				Exceptional procedure
	a'4	MIS O---------->				"SCM not supported by terminal 1"

6.1.2 Further capability exchanges

Capability exchanges may be initiated by terminals in the same way as for point-to-point calls, and by the MCU, when necessary, to accommodate the different capabilities declared by terminals connected to its ports.

6.1.3 BAS sequencing

The principles specified in ETS 300 143 [14], subclause 5.3, shall be followed. In addition, the MCU shall transmit the C&I symbols **MCC** and **MCS** (if relevant) to all terminals along with usual repetitions of BAS commands. This ensures that they remain aware of their participation in a multipoint call.

6.1.4 Mode switching procedures

To ensure that a MCU has adequate control, and in particular that it can drive video transmission to a common rate (this excludes the case of video transcoding), bit-rate changes shall be initiated solely from the MCU. Terminals, after having received **MCC** and **MCS** from the MCU, shall not change bit-rates except in response to such a command from the MCU. This allows the maintenance of bit-rate symmetry for audio, video, optional data sub-channels, Encryption Control Signal (ECS), and overall transfer rate.

A data rate change can only be initiated by the MCU; since a data channel is concerned, the master MCU shall wait possession of the related data token.

When a bit-rate change is made by the MCU, the terminals shall follow suit as soon as possible since any delay may preclude the transmitted signals from being received by the other parties.

> NOTE: Audio and video mode changes which do not involve a bit-rate change may be initiated by terminals.

6.1.5 Video bit-rate changing procedure

As a consequence of changing the bit-rate of other signals, the video rate, which occupies all available bits (not allocated to other signals), changes in various circumstances. The MCU proceeds in successive steps:

- it transmits **VCF** and **Video-Off** command to all terminals; they shall freeze their currently displayed picture and monitor Picture Headers for the Freeze Picture Release command (see ITU-T Recommendation H.261 [16]);

- it transmits the BAS commands asking a new video bit rate;

- it waits T_c until any terminal has responded by symmetrising its transmission, and new bit-rates have been established for other signals;

- it sends the **Video-On** command to all terminals, keeping the same routing as before; then the error correction frame alignment is lost by the terminals and takes a time T_e to recover;

- after a time longer than T_e, the MCU transmits **VCU** to the selected video source (terminal); this one sends its next video frame in Fast-Update mode together with the Freeze Picture Release command;

- the terminals display an image after T_u and then revert to the normal video mode.

> NOTE: T_u is inversely proportional to video bit rate (about 0,5 s at 320 kbit/s); T_c and T_e are not specified.
>
> The time necessary to change video bit rate is approximately: $T_c + T_e + T_u$.

6.1.6 Video switching procedures

6.1.6.1 Automatic switching

When automatic switching is effective, the MCU controls the terminals using **VCF** and **VCU** commands as described in table 3.

The procedure is similar to the three last steps of subclause 6.1.5. and the resulting switching time is approximately $T_e + T_u$.

> NOTE: Alternatively, the MCU may process the switched video signal in order to avoid loss of error correcting frame and to decrease overall image switching time.

As an option, the MCU may transmit **MIV** to the selected terminal (steps a'4, a'5).

Table 3: Video switching procedures (without Chair-control)

Procedures	Steps	MCU	Terminal 1	Terminal 2	Terminal 3	Comments
						Initial routing **3 → 1** **3 → 2** **1 → 3**
AUTOMATIC SWITCHING (Terminal 2 is selected)	a1	VCF O---------->				New routing 2 → 1
	a2	VCF O-->				3 → 2 (no change) 2 → 3
	a3	VCU O--------------------------->				Freeze Picture Release command is transmitted in video signal (ITU-T Recommendation H.261 [16]).
Option " Indication of video broadcast "	a'4	Cancel-MIV O-->				
	a'5	MIV O--------------------------->				
CONTROLLED SWITCHING • terminal 1 asks MCV	b1	MCV <----------O				New routing 2 → 1 1 → 2 1 → 3
	b2	MIV O---------->				
• terminal 2 asks MCV	c'1	MCV <-------------------------O				MCU rejects a new MCV while another is active.
	c'2	VCR O--------------------------->				
• terminal 1 asks Cancel-MCV	b3	Cancel-MCV <----------O				MCU returns to the automatic switching mode.
	b4	Cancel-MIV O---------->				

6.1.6.2 Controlled switching

A terminal can try to force the MCU to broadcast its video signal to all other ports, overriding the automatic switching mechanism, by transmitting **MCV**.

In normal conditions, the MCU switches the video accordingly and acknowledges the command with **MIV** indication (steps b1, b2). When an **MCV** is already in force, any new **MCV** command shall be rejected and **VCR** returned to the requesting terminal (steps c'1 and c'2).

The video signal transmitted to the terminal which is the source of the distributed video is left at the discretion of the implementer; it may be:

- the previous video signal;
- the video signal from Conference control terminal if available;
- all other video signal cyclically switched (e.g. 20 s for each participant).

Return to the automatic switching mode is controlled through the exchange of **Cancel-MCV** and **Cancel-MIV** (step b3, b4).

6.2 Videoconference with multiple MCUs

Two, three or more MCUs may be interconnected to optimise the multipoint communication arrangement. Each MCU has roughly the same functions as when it operates alone, treating another MCU as though it were a terminal, taking the decision as to transmission mode according to received capabilities, and switching audio/video signals as previously described. A MCU forwards messages it cannot handle alone.

In addition, some specific procedures apply.

6.2.1 Designation of master MCU

After each initial channel has been established between MCUs, each MCU sends **MCC** and its current cap-set as specified in subclause 6.1.3 and so, each one becomes aware that it is connected to another MCU.

One MCU shall take on the master role:

a)   for a star configuration, it is essential that the master be that at the centre and therefore shall be designated at conference registration time. As soon as it is connected to another, it shall send **MIM** and ignore similar messages coming from other MCUs.

b)   for a dumb-bell configuration (two MCUs), when no master has been previously designated, the role of master shall be assigned by a random procedure as described below.

Each MCU having received **MCC**, but not **MIM**, transmits a random Single Byte Extension (SBE) number; the MCU which receives a higher number than it transmitted, assumes the master role and transmits **MIM** to the other. The process shall be repeated if both numbers happen to be the same.

When one MCU has been designated master, the slaves shall symmetrise to the rates transmitted by the master.

A slave shall adopt the choice made by the master, and the master shall ignore the action taken by the slave, expecting this to be corrected within a short time.

6.2.2 Initialisation

As long as no terminal is connected to a MCU, it shall transmit **MIZ** to all ports without any audio signal. As soon as a local terminal is connected, the MCU transmits **Cancel-MIZ** to the other ports and the related audio signal is forwarded via the APU.

When a MCU has established communication with only one terminal, and receives **MIZ** from other MCUs, it does not proceed as described in subclause 6.1.1 until either it receives **Cancel-MIZ** from another MCU or connects itself to a second terminal.

6.2.3 Common operating mode

Operation of each MCU shall follow the procedures of subclause 6.1 considering other MCUs like terminals, and taking into account the special features specified below, and illustrated in table 4:

-       a MCU <X> receiving **VCU** from another MCU <Y> shall forward **VCU** to the terminal (or other MCU) presently source of video signal transmitted to MCU <Y> and broadcast to local terminals;

-       a MCU <X> receiving **VCF** from another MCU <Y> shall forward **VCF** to the terminals (or other MCUs) to which it is presently broadcasting the video signal received from MCU <Y>;

-       a MCU <X> receiving an acceptable (cf. subclause 6.1.6.2) **MCV** command, from a local terminal (or another MCU) shall override voice activated automatic video switching and forward **MCV** to other MCUs (cf. table 4 steps a1 to a3);

-       when this command is not acceptable, it is rejected by MCU <X> returning **VCR** (cf. steps a4 and a5);

-   in case of a collision between two **MCV** commands then MCUs shall return **VCR** to the other MCU, restore the automatic switching mode and forward **Cancel-MIV** to the requesting terminal or MCU (cf. steps c1 to c3);

-   a slave MCU is not allowed to initiate any mode change but shall follow the terminal behaviour which is described in subclauses 6.1.4 and 6.1.5 (cf. also annex A).

Table 4: Video switching procedures (case of two MCUs)

Procedures	Steps	Terminal 1	MCU 1	MCU 2	Terminal 2	Observations
Forwarding MCV	a1	MCV O------------>				
	a2	MIV <--------------O	MCV --------->			
	a3		MIV <---------O			
Rejecting another MCV	a4			MCV <-------------O		MCU 1 and MCU 2 reject any other MCV while another is in force
	a5			VCR O------------->		
Forwarding Cancel-MCV	b1	Cancel- MCV O------------>				
	b2	Cancel-MIV <-------------O	Cancel-MCV ----------->			
	b3		Cancel-MIV <-----------O			
Collision of two MCV	c'1 + c"1	MCV O------------->		MCV <--------------O		
	c'2 + c"2	MIV <-------------O	MCV --------->	MIV <---------O-------------->		c'2 and c"2 events are quasi simultaneous
	c'3 + c"3	Cancel-MIV <-------------O	VCR ---------->	Cancel-MIV <---------O-------------->		c'3 and c"3 events are quasi simultaneous

6.3 Special maintenance procedures

6.3.1 Loop control

A MCU may be designed to control loop-backs in audiovisual terminals supporting this option. The MCU shall transmit the related BAS Command:

-   **LCA**: audio signal loop
-   **LCD**: digital signal loop
-   **LCV**: video signal loop
-   **LCO**: loop-back off

Similar procedures may be used to control loops in a MCU from a special terminal or another MCU.

6.3.2 Loop detection

When the transmission circuit has been looped (e.g. in a remote terminal) a test may be performed by comparing the BAS codes sent and received within a reasonable time delay.

The message shall consist in **MIL,<N>** where N is a random SBE number between 0 and 223. The test may be repeated with a different number in order to improve its reliability.

7   Basic in-band signalling requirements for MCUs

MCUs shall support various in-band signalling procedures in addition to the requirements specified in ETS 300 143 [14].

The basic requirements related to enhanced functionalities such as terminal numbering, Conference control and Data facilities are specified in other ETSs.

Table 5 shows how C&I codes listed in ETS 300 144 [1] shall be supported according to the basic functionalities and options declared by MCUs. This table also indicates whether these codes are transmitted or received by MCUs, the message type, and the related clause/subclause in this ETS when applicable.

The following symbols apply:

C:	Command	
I:	Indication	
BAS:	Simple BAS Code	
SBE:	Functional SBE which follows an Escape code	(111)[17]
N:	SBE "number" which follows an Escape code	(111)[19]
MBE:	MBE message which follows an Escape code	(111)[25]
-->O:	Message received by a MCU	
O-->:	Message sent by a MCU	
-->X-->:	Message forwarded to other entities	
M:	Mandatory	
CM "n":	Mandatory when functionality "n" is declared	
O "p":	Option of type "p"	

Main functionalities:

n = 1: Controlled video switching;
n = 2: Multi-MCU capability.

Various types of options:

p = 1: Improved maintenance;
p = 2: Improved management of video switching.

Table 5: C&I mandatory for MCUs

C&I	C/I	Name	Type	Transmission	Basic Function	OPTION	Reference
AIA	I	Audio Active	SBE	O--> -->O -->X-->	M M M		subclause 10.2.2.2 /ETS 300 144 [1]
AIM	I	Audio Muted	SBE	O--> -->O -->X-->	M M M		subclause 10.2.2.2 /ETS 300 144 [1]
LCA	C	Loop Audio	BAS	O--> -->O		O 1 ?	subclause 10.1.3 /ETS 300 144 [1]
LCD	C	Loop Digital	BAS	O--> -->O		O 1 ?	subclause 10.1.3 /ETS 300 144 [1]
LCV	C	Loop Video	BAS	O--> -->O		O 1 ?	subclause 10.1.3 /ETS 300 144 [1]
LCO	C	Loop Off	BAS	O--> -->O		O 1 ?	subclause 10.1.3 /ETS 300 144 [1]
MCC	C	Multipoint Conference	SBE	O-->Trm. MCU-->O	M CM 2		subclause 6.1.1 subclause 6.2.1
Cancel-MCC	C	Cancel MCC	SBE	O-->Trm. MCU-->O	? ?		subclause 10.2.2.3 /ETS 300 144 [1]
MCV	C	Multipoint Video forced	SBE	-->O -->X-->	CM 1 CM 2		subclause 6.1.6.2 subclause 6.2.3
Cancel-MCV	C	Cancel MCV	SBE	-->O -->X-->	CM 1 CM 2		subclause 6.1.6.2 subclause 6.2.3
MIL	I	Multipoint Loop	SBE+1N	O--> -->O		O 1 ?	subclause 6.3 2 subclause 6.3 2
MIM	I	Multipoint Master MCU	SBE	O--> MCU-->O	CM 2 CM 2		subclause 6.2.8.1 subclause 6.2.8.1
MIS	I	Mult. Secondary status	SBE	O-->Trm. MCU-->O	M CM 2		subclause 6.1.1 subclause 6.1.1
Cancel-MIS	I	Cancel MCS	SBE	O-->Trm. MCU-->O	? ?		subclause 10.2.2.3 /ETS 300 144 [1]
MIZ	I	Mult. Zero connection	SBE	O--> MCU-->O	M CM 2		subclause 6.1.1 subclause 6.2.2
Cancel-MIZ	I	Cancel MIZ	SBE	O--> MCU-->O	M CM 2		subclause 6.1.1 subclause 6.2.2
RAN	I	Random number	SBE+1N	O-->MCU MCU-->O	CM 2 CM 2		subclause 6.2.1 subclause 6.2.1

(continued)

Table 5 (concluded): C&I mandatory for MCUs

C&I	C/I	Name	Type	Transmission	Basic Function	OPTION	Reference
VCF	C	Video Freeze picture	BAS	O--> -->O -->X-->	CM 1 CM 2 CM 2		subclause 6.1.5 subclause 6.2.3 subclause 6.2.3
VCR	C	Video request Rejected	SBE	O--> -->O -->X-->	CM 1 CM 2 CM 2		subclause 6.1.6.2 subclause 6.1.6.2 subclause 6.2.3
VCU	C	Video Update request	BAS	O--> -->O -->X-->	CM 1 CM 2 CM 2		subclause 6.1.6 subclause 6.2.3 subclause 6.2.3
VIA	I	Video Active	BAS	O--> -->O -->X-->	CM 1 CM 1 CM 2		
VIA2	I	Video # 2 Active	BAS	O--> -->O -->X-->	CM 2	O 2	
VIA3	I	Video #3 Active	BAS	O--> -->O -->X-->	CM 2	O 2	
VIR	I	Video Ready-to-activate	BAS	O--> -->O -->X-->	CM 2	O 2	
VIS	I	Video Suppressed	BAS	O--> -->O -->X-->	CM 2	O 2	

Annex A (informative):   Requirements applicable to audiovisual terminals

A.1   Functional requirements

A.1.1   Basic multipoint operation

There are no additional requirements, to allow multipoint operation of any telephony (3,1 kHz or 7 kHz), videotelephony or other audiovisual terminal, as soon as it conforms to the relevant standard (e.g. I-ETS 300 442 for a videotelephony terminal).

However, interworking between several types of terminals may be limited by several factors:

-       the network may not support fall-back;

-       a MCU of Class 3 or 4 may, as an option, reject call attempts made or answered by a telephony terminal;

-       while a MCU activates data transmission or one of its data applications, a videotelephony terminal which does not support this facility shows a frozen picture.

In order to avoid this last situation, it is strongly recommended that any audiovisual terminal, which is not supporting any data facility, simulates relevant "dummy" capabilities.

A.1.2   Enhanced multipoint operation

There are many additional functionalities to be considered; some are optional for videotelephony terminals but become mandatory for videoconference terminals. Table A.1 lists the various attributes which are used to characterize an audiovisual terminal.

The minimum requirements are listed as necessary attributes (N).

The support of some functional attributes identified (R) is recommended.

The attributes marked (*) identify options which may be supported independently.

Some attributes marked (n) relate to "bound" functionalities, which cannot be reasonably provided separately; they are defining an option package.

When several attributes are marked (C), this means that at least one of these functionalities need to be supported by a terminal.

When there is no entry for one attribute in a Class column, this means that it is inopportune or useless.

A.1.2.1   In-band signalling procedures

The basic terminal requirements are listed in clause A.2. The requirements related to enhanced modes are not included in this ETS.

A.1.2.2   Additional keyboard and display

Several optional functionalities require an enhanced man machine interface which may be provided by special keys on the keyboard and special display facilities (separate display or screen overlay). The relevant minimum requirements are indicated, in table A.1, respectively by the symbols K and D.

Use of identified "keys" and "displays" is indicated below:

Table A.1: Requirements versus terminal type

N°	Attributes	Values	Terminal class		Special Requirements
			Enhanced Videotelephony Terminal	Video Conference Terminal	Keyboard = K Display = D
1	Type of network interface	ISDN Basic access ISDN Primary rate G.703 leased line V.35 leased line	R * * *	* R * *	
2	Transfer rate	64 kbit/s or 1 B 128 kbit/s or 2 B 384 kbit/s or 6 B > 384 kbit/s	 R * *	 N * R	
3	Audio coding algorithm	G.711 [3] + G.728 [2] G.711 [3] + G.722 [4] G.711 [3]+ G.722 [4]+ G.728 [2]	 N *	 N *	
4	Interworking capability	"SM-Comp" capability "Dummy" capability	* R	R R	
5	Conference control		R	N	K (a)+ D (a)
6	Video control	none video broadcast select video received request for the floor	C C * *	 N R N	 K (b) K (c)+ D (c) K (d)
7	Terminal numbering		*	N	D (e)
8	Data facility		*	R	K (f)+ D (f)
9	Management of additional information (user, call, token)		R(1)	R(1)	K (g)+ D (g)
10	MBE facility		*(1)	N(1)	
11	Remote control of video camera			*	K (h)

K (a)	to add or drop a terminal, to close the conference, to assign Chair token,
D (a)	to see floor requests, remind token assignment, identify connected terminals,
K (b)	to control broadcast of own video,
K (c)	to select received video,
D (c)	to indicate separate control of received video
K (d)	to request the floor,
D (e)	to identify received video signal,
K (f)	to request data token,
D (f)	to see data token assignment,
K (g)	to ask info (e. g. token assignment), enter name, location, password, etc.
D (g)	to display various info,
K (h)	to control camera orientation, zoom and/or to select document camera.

A.2   In-band signalling requirements

In order to be able to support multipoint communications, videotelephony and/or videoconference terminals need to support various in-band signalling procedures in addition to the requirements specified in ETS 300 143 [14].

Several types of terminals can be considered:

a)   terminals without multipoint capability;

b)   terminals with the minimum "basic" multipoint capability;

c)   terminals designed for videoconference.

In the last case, videoconference terminals support at least the Conference control function, and optionally, data transmission.

The protocols necessary to support the enhanced functionalities of a videoconference are not described in this annex.

Table A.2 shows how C&I codes listed in ETS 300 144 [1] are supported according to the functionalities and options declared by terminals of type b).

This table also indicates whether these codes are transmitted or received by terminals, the message type, and the related clause/subclause in this ETS when applicable.

The following symbols apply:

C:	Command
I:	Indication
BAS:	Simple BAS Code
SBE:	Functional SBE which follows an Escape code (111)[17]
N:	SBE "number" which follows an Escape code (111)[19]
MBE:	MBE message which follows an Escape code (111)[25]
-->O:	Message received by a terminal
O-->:	Message sent by a terminal
R:	Required
CR "n":	Required when functionality n is declared
O "p":	Option

Main functionalities:

n = 1: Basic multipoint communication capability;
n = 2: Video control capability.

Various types of options:

p = 1: Improved maintenance;
p = 2: Improved management of video switching.

Table A.2: C&I required for audiovisual terminals

C&I	C/I	Name	Type	Transmission	Simple terminal	Terminal with Basic Multipoint capability	OPTION	Reference
AIA	I	Audio Active	SBE	O--> -->O	R R			subclause 10.2.2.2 /ETS 300 144 [1]
AIM	I	Audio Muted	SBE	O--> -->O	R R			subclause 10.2.2.2 /ETS 300 144 [1]
LCA	C	Loop Audio	BAS	O--> -->O			O 1 O 1	subclause 10.1.3 /ETS 300 144 [1]
LCD	C	Loop Digital	BAS	O--> -->O			O 1 O 1	subclause 10.1.3 /ETS 300 144 [1]
LCV	C	Loop Video	BAS	O--> -->O			O 1 O 1	subclause 10.1.3 /ETS 300 144 [1]
LCO	C	Loop Off	BAS	O--> -->O			O 1 O 1	subclause 10.1.3 /ETS 300 144 [1]
MCC	C	Multipoint Conference	SBE	-->O		CR 1		subclause 6.1.1
Cancel-MCC	C	Cancel MCC	SBE	-->O		?		?
MCV	C	Multipoint Video forced	SBE	O-->		CR 2		subclause 6.1.6.2
Cancel-MCV	C	Cancel MCV	SBE	O-->		CR 2		subclause 6.1.6.2
MIS	I	Mult. Secondary status	SBE	MCU-->O		CR 1		subclause 6.1.1
Cancel-MIS	I	Cancel MCS	SBE	MCU-->O		?		subclause 10.2.2.3 /ETS 300 144 [1]
MIV	I	Multipoint Visualisation	SBE	MCU-->O		CR 2		subclause 6.1.6.2
Cancel-MIV	I	Cancel MIV	SBE	MCU-->O		CR 2		subclause 6.1.6.2
MIZ	I	Mult. Zero connection	SBE	MCU-->O		CR 1		subclause 6.1.1
Cancel-MIZ	I	Cancel MIZ	SBE	MCU-->O		CR 1		subclause 6.1.1
VCF	C	Video Freeze picture	BAS	O--> -->O	R R			subclause 6.1.5
VCR	C	Video request Rejected	SBE	MCU-->O		CR 2		subclause 6.1.6.2
VCU	C	Video Update request	BAS	O--> -->O	R R			subclause 6.1.5
VIA	I	Video Active	BAS	O--> -->O	R R			subclause 10.2.2.1 /ETS 300 144 [1]
VIA2	I	Video # 2 Active	BAS	O--> -->O			O 2 O 2	subclause 10.2.2.1 /ETS 300 144 [1]
VIA3	I	Video #3 Active	BAS	O--> -->O			O 2 O 2	subclause 10.2.2.1 /ETS 300 144 [1]
VIR	I	Video Ready-to-activate	BAS	O--> -->O			O 2 O 2	subclause 10.2.2.1 /ETS 300 144 [1]
VIS	I	Video Suppressed	BAS	O--> -->O			O 2	subclause 10.2.2.1 /ETS 300 144 [1]

Annex B (informative): Bibliography

The following documents are referenced informatively by this ETS.

- ITU-T Recommendation T.122: "Multipoint communication service for audiographic and audiovisual systems. Service definition".

- ITU-T Recommendation T.123 (1994): "Protocol stacks for audiographic and audiovisual teleconference applications".

- ITU-T Recommendation T.124 (1995): "Generic Conference Control".

- ITU-T Recommendation T.125 (1994): "Multipoint communication service protocol Specification".

- ITU-T Recommendation T.126 (1995): "Multipoint still image and annotation protocol".

- ITU-T Recommendation T.127 (1995): "Multipoint binary file transfer".

- I-ETS 300 442: "Integrated Services Digital Network (ISDN): Videotelephony teleservice: Terminal characteristics".

- ITU-T Recommendation G.703 (1991): "Physical/electrical characteristics of hierarchical digital interfaces".

- CCITT Recommendation V.35 (1988): "Data transmission at 48 kilobits per second using 60-108 kHz group band circuits".

- ITU-T Recommendation H.243 (1993): "Procedures for establishing communication between three or more audiovisual terminals using digital channels up to 2 Mbit/s".

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