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1. INTRODUCTION

In the July 7, 1995 version of H.245, the mapping between H.221/H.230 commands and the equivalent H.245 structures is not always clear. Also, unless these mappings are defined, a strong risk of varying implementations leading to interoperability problems exists. Such mappings need to exist for both H.324 and H.323. They are not required for H.310 terminals since these terminals will operate in an H.320 mode, thus there is no requirement for an H.230/H.221 command to H.245 command mapping. This document takes the viewpoint of the H.323 gateway attempting to interface an H.323 terminal using H.245 on the LAN side to an H.320 terminal or an H.231 MCU on the WAN side. The particular cases focus(mainly) on the receipt of an H.221 or H.230 command by the H.323 gateway, and its response or action on the LAN side. The action in the reverse case is easily produced by consideration of this table. Much of this discussion will apply to H.324, but this requires additional work.

My current plan is that this document would (after hopefully generating changes to H.245), become part of H.323. I have received input from the LBC meeting that they would prefer this material to be in H.245, as it may apply for both H.324 and H.323. This requires further discussion.

This document has not received much review, and I fear I have misunderstood many H.245 tools. Certainly I do not claim to understand H.245 very well, and I have not presumed to suggest ASN.1 for all my proposed additions. As I write this, I have not seen any detailed output of the LBC meeting as it relates to this document.

Generally H.221/H.230 commands are continuously repeated in the unreliable BAS channel. As the control channel on the LAN side will be reliable, only new or changed commands are passed on the by the H.323 gateway to the LAN side.

Comments in **Bold Face** indicate areas that I believe probably require changes to H.245.

This paper is based on the idea that H.323 terminals should be able to participate in H.243 conferences without handicapp, e.g receive TIN, TID, VIN, send TIF, MCV, etc. and further that MCU-type multipoint operation is mandatory on H.323 terminals(and hopefully H.324 as well)

It may be that we do not wish to extend the H.243 chair control commands to H.245; I am personally comfortable with requiring the chair terminal to be a T.120 terminal in H.323/4. However, my understanding is that T.AVC will be considerably delayed (2 years), and we in SG15 are being encouraged by SG8 to used BAS code for various things. Will there ever be H.324 chair terminals? Is it acceptable to the H.324 community that chair H.324 terminals must also be T.120 terminals? We should all give this issue further consideration.

2. H.221 COMMANDS/CAPS

2.1. A.1 Commands

In this table I have assumed that if the audio operates at a well known rate, e.g. 16 kbit/sec, there is no need to send an H.245 flow control message since the rate can be inferred from the logical channel open. If this is not the case, or it this violates the philosophy of H.245, an additional flow control message can be send to set the rate.

H.221 command	H.245 equivalent
Neutral	Close the logical channel being used for audio Close any logical data channels that exist only in the I-channel on the WAN side Send FlowControlCommand to limit the video rate to that equivalent to whatever is on in the additional channels on the WAN side Send FlowControlCommand to limit the HSD data rate to be equivalent to whatever is on in the additional channels on the WAN side(if needed)

Capex	The gateway should respond for the H.323 terminal using the last transmitted cap set. ***Do we need a command to stimulate an end-to-end cap exchange?***
Au-off, U	Close the logical channel being used for audio
Au-off, F	Close the logical channel being used for audio
A-law, 0U	Open a logical channel with AudioCapability of g711Alaw64k
A-law, 0F	Open a logical channel with AudioCapability of g711Alaw56
u-law, 0U	Open a logical channel with AudioCapability of g711Alaw64k
u-law,0F	Open a logical channel with AudioCapability of g711Alaw56
A-law,F6	***Probable H.245 change***
u-law,F6	***Probable H.245 change***
G.722-64	Open a logical channel with AudioCapability of g722-64k
G.722-56	Open a logical channel with AudioCapability of g722-56k
G.722-48	Open a logical channel with AudioCapability of g722-48k
Au-40k	not needed yet
Au-32k	not needed yet
Au-24k	not needed yet
G.728	Open a logical channel with AudioCapability of g728
Au<16k(G.729?)	Open a logical channel with AudioCapability of g729k

2.2. A.2 Commands

In general, transfer rates get translated into flow control commands that apply to the data and video logical channels. The gateway must use the H.245 flow control commands in such a fashion that the total of data, video, and audio(as possibly transcoded in the gateway) is equal to the available bandwidth set by the transfer rate commands on the WAN side. Thus, the LAN side is unaware of the differences between multi-link channels and single link channels, nor must the total bandwidth on each side be exactly equal, since control on the LAN side is essentially unconstrained, and the audio may be transcoded in the gateway. A loss-ic received by the gateway is translated into a lower LAN bit rate for the appropriate media, probably video, via an H.245 flow control command.

2.3. A.3 Commands

H.221 command	H.245 equivalent
Video-off	Close the logical channel using video
H.261	Open a logical channel with VideoCapability of H261VideoCapability and follow with a flow control message for that channel to force a match to the WAN side video rate. **It is unclear how the MPI or TradeoffCapability fields are filled in in the H.245 message - are they ignored???**
Vid-imp	Not yet needed
Video-ISO	**Need to add MPEG1 capabilty to H.245!**
Freeze-pic(VCF)	Send videoFreezePicture
Fast-update(VCU)	Send videoFastUpdatePicture
ECS on	There is no equivalent, but none is needed. In effect, on the LAN side the ECS channel is always open. HOWEVER, a flow control command must be issued to correct the video and possibly the data rates for appropriate logical channels.
ECS off	See ECS-on
Au-loop	Send mediaLoop or logicalChannelLoop on the logical channel carrying audio. **The type of message to send, and the definition of the loop must be added to H.323.**
Vid-loop	Send mediaLoop or logicalChannelLoop on the logical channel carrying audio. **The type of message to send, and the definition of the loop must be added to H.323.**
Dig-loop	**The meaning of this loop for H.323 must be defined clearly for H.323; it is unclear whether the current H.245 tools are sufficient.**
Loop-off	Send the MaintenanceLoopOffCommand
SM-comp	Send appropriate flow control messages on open logical channels.
Cancel-SM-comp	Send appropriate flow control messages on open logical channels.

6B-H0-comp	Send appropriate flow control messages on open logical channels.
Not-6B-H0comp	Send appropriate flow control messages on open logical channels.
Restrict	Close any existing audio channel, and open a new one with a rate reduced by 8 kbit/sec. Use flow control messages to appropriately adjust the video and data logical channel rates.
Derestrict	Close any existing audio channel, and open a new one with a rate increased by 8 kbit/sec. Use flow control messages to appropriately adjust the video and data logical channel rates.

2.4. A.4 Commands

It would appear that the gateway, upon receipt of an LSD/HSD command, would seek to open a logical channel with a DataApplication Capability of either h224 or userData, with corresponding DataProtocolCapability of transparent or V14buffered. **It is unclear how V.120 is signaled in H.245.** Based on the actual rate of the LSD/HSD channels, or perhaps their combined rates, appropriate H.245 flow control messages would be issued. **Another issue is that the gateway may not know the type of application immediately. Should it hold off on opening the H.245 logical channel until the application command arrives? This appears to risk losing user data.**

Upon receipt of an MLP command, the gateway would seek to open a logical channel with a DataApplicationCapability of either t120 or h224, and a DataProtocolCapability of hdlcFrameTunneling. **The same issue mentioned above arises, namely that the gateway will not know the application type immediately.** Once again, H.245 flow control messages will be sent to force the rates to match appropriately.

2.5. A.6/A.7/A.8/A.10 Capabilities

H.245 lacks a cap for ISO/IEC 11172-2(MPEG1). It should be added.

Since there are no longer any transfer rate caps, it is impossible to say in H.245 what the maximum rate the H.261 decoder can handle is. A maximum bit rate exists for H.263 and H.262; one is needed for H.261. The gateway can then be guided by this value in sending the WAN side cap set; otherwise it while have no idea what transfer rates are supportable.

A similar problem exists for MLP caps; there is no way of saying what MLP rates the H.323 terminals are capable of terminating, and no way for the gateway to know what cap set to put forward on the WAN side. The same applies for LSD/HSD caps.

2.6. A.9 Escape Table Values

H.221 command	H.245 equivalent
Table A.5	The transfer rates (commands & caps) translate into H.245 flow control messages. **A general issue is whether the flow control messages imply a minimum as well as a maximum bit rate.**
Table A.2	**The Au-ISO related caps/cmds shall be ignored(?).** The HSD/MLP transfer rate commands result in the opening of a logical channel. **See the section on A.4 for a discussion of the issues.**
H.230	See H.230 section
SBE numbers	**Issue: Need mechanism to send them in H.245 for "BAS DTMF"**
SBE characters	They are always embedded in other messages so there is no direct translation, eg. they are associated with MLP or H.230 commands
Start-MBE	**Should there be a general "pass this MBE on" message?**
NS-cap	Send Capability with nonStandard set to the appropriate NonStandardParameter. **Exactly how this is done is not clear to me.**
NS-comm	Send NonStandardPDU with nonStandardData set to the appropriate NonStandardParameter. **Exactly how this is done is not clear to me.**
Cap-mark	When H.320 cap set ends, the H.245 cap set can be sent.
Table A.3	See section on Table A.3

2.7. Table A.3 Data Applications

Reserved codepoints are ignored in this table. Note that on the H.221 side, the data channel is opened, and then various applications are turned on/off. On the H.245 side, the application is specified when the logcial channel is opened. Thus, we must defer opening logical data channels on the LAN side until it is clear what application is to be used. **Note: I may have misunderstood this!**

Table A.3 H.221 command	**H.245 equivalent**
V.120 LSD	**None - need codepoint for new DataModeProtocol?**
V.120 HSD	**None - need codepoint for new DataModeProtocol?**
V.14 LSD	Open a logical channel with DataMode of userData and DataModeProtocol of v14buffered. Use the flow control command to match rates.
V.14 HSD	Open a logical channel with DataMode of userData and DataModeProtocol of v14buffered. Note that HSD and LSD can simply map into different logical data channels on the H.245 side. Use the flow control command to match rates.
H.224_MLP_on/off	Open a logical channel with DataMode of h224 and DataModeProtocol of hdlcFrameTunneling (or close as appropriate). Use the flow control command to match rates.
H.224_LSD_on/off	Open a logical channel with DataMode of h224 and DataModeProtocol of transparent(or close as appropriate). Use the flow control command to match rates.
H.224_HSD_on/off	Open a logical channel with DataMode of h224 and DataModeProtocol of transparent(or close as appropriate). Use the flow control command to match rates.
T.120_on/off	Open a logical channel with DataMode of t120 and DataModeProtocol of hdlcFrameTunneling (or close as appropriate). Use the flow control command to match rates.

Here I covered the caps since they raise some interesting questions.

Table A.3 H.221 capability	H.245 equivalent
Still Image(H.261 Annex D)	**None; probably needed or do we say only T.120 may be used? What about existing systems using Annex D?**
V.120 LSD	**None; probably needed**
V.120 HSD	**None probably needed**
V.14 LSD	DataModeProtocol of v14buffered
V.14 LSD	DataModeProtocol of v14buffered
H.224_MLP	DataMode of h224 on a ModeProtocol of hdlcFrameTunneling
H.224_LSD	DataMode of h224 on a ModeProtocol of transparent
H.224_HSD	DataMode of h224 on a ModeProtocol of transparent
T.120	DataMode of t120 on DataModeProtocol of hdclFrameTunneling
H.224_sim	**None; still needed; implies appility to open two logical channels, one running h224 on LSD/HSD, and the other running t120 on MLP.**
Nil_data	Not needed; has no meaning on LAN side; gateway should always present Nil_data cap to WAN side.

2.8. A.11 HSD/H-MLP Commands

These commands are translated into open logical channel requests. Flow control commands are used to match the WAN side rate. **Apparently, the channel is not opened until the data application code is sent.**

2.9. A.12/A.13 Au-ISO Commands & Capabilities

It appears that no H.245 equivalent is needed.

2.10. A.14/A.15 Data Application Commands & Capabilities

See Table A.3/H.221 above.

2.11. A.16 Transfer Rate Commands and Caps used in Channel Aggregation

All general issues raised about transfer rates apply here as well.

3. H.230 COMMANDS

Table A.1 H.230 command/indication	H.245 equivalent
AIM	Send logicalChannelInactive for the audio channel
AIA	Send logicalChannelActive for the audio channel
ACE	Send equalizeDelay on the audio logical channel
ACZ	Send zeroDelay on the audio logcial channel
TCI	**None - need means to request H.243 terminal ID - suggest translation of both TCI and TCS-2 into a single H.245 request.**
TII*	**None - need a single H.245 response to both TCI and TCS-2.**
TIS	None needed, when it is received the H.245 command to extract the terminal id string is sent.
VIS	Send logicalChannelInactive for the video channel
VIA	Send logicalChannelActive for the video channel
VIA2	**Unclear how to handle**
VIA3	**Unclear how to handle**
VIR	**Unclear how to handle**

MCC	**Apparently, send Miscellaneous indication multipointConference, which is said to be "like MIC" - a non-existent H.230 command. This H.245 "indication" should be moved to the MiscellaneousCommand area, changed to be "like MCC" and extended to compel both mode and rate symmetry. It also should be described as mandatory on all H.3xx terminals using H.245(yes, I know this violates the H.245 philosophy)**
Cancel-MCC	See above, apparently cancelMultipointConference.
MIZ	Send multipointZeroComm
Cancel-MIZ	Send cancelMultipointZeroComm
MIS	Send multipointSecondaryStatus
Cancel-MIS	Send cancelMultipointSecondaryStatus
MIM	**Unclear; procedures seem unsettled**
TIC	Gateway may support, but no need for H.245 equivalent.
TIX	Gateway may support, but no need for H.245 equivalent.
RAN	**Unclear; procedures seem unsettled**
TIA*	**No procedure; needed for operation with H.243 MCU**
TIN*	**No procedure; needed for operation with H.243 MCU**
TID*	**No procedure; needed for operation with H.243 MCU**
TCU	**No procedure; needed for operation with H.243 MCU**
TCA	Probably not needed in H.245
MCV	**No procedure; needed for operation with H.243 MCU**
Cancel-MCV	**No procedure; needed for operation with H.243 MCU**
MIV	**No procedure; needed for operation with H.243 MCU**
Cancel-MIV	**No procedure; needed for operation with H.243 MCU**

MCS/MCN	**It is not clear that an equivalent is really needed; a properly defined MCC equivalent would cover all medias, so MCS/MCN would translated into MCC/Cancel-MCC equivalents**
VIN*	**No procedure; needed for operation with H.243 MCU**
VCB/Cancel-VCB	**It is possible we don't want H.243 chair control for H.323 terminals; if so there is no need for an equivalent**
VCS/Cancel-VCS	**No procedure; needed for operation with H.243 MCU**
VCR	**No procedure; needed for operation with H.243 MCU**
MIL*	**Probably not needed in H.245; gateway would perform loop test between itself and the MCU/terminal sending MIL, if it supported MIL, which is optional.**
CIC/CCD*/.CIR/CCK/CCA/CIT/CCR/CIS	**See VCB/Cancel-VCB**
TIF*	**No procedure; needed for operation with H.243 MCU**
DCA-L,DIT-L,DCR-L,DIS-L,DCC-L	Assuming we agree on how LSD gets to the H.323 endpoint, the terminal would attempt to open a logical channel for data to the gateway, and the gateway would perform all required H.243 token related signaling on its behalf. When the token was granted, the gateway would send OpenLogicalChannelAck or OpenLogicalChannelReject as appropriate
DCA-H,DIT-H,DCR-H,DIS-H,DCC-H	Assuming we agree on how HSD gets to the H.323 endpoint, the terminal would attempt to open a logical channel for data to the gateway, and the gateway would perform all required H.243 token related signaling on its behalf. When the token was granted, the gateway would send OpenLogicalChannelAck or OpenLogicalChannelReject as appropriate

DCM (send)	The H.323 terminal sends a RequestMode with a dataMode of t120 and a DataModeProtocol of hdlcFrameTunneling. The H.323 gateway will send a DCM to an attached MCU or terminal. When the MLP rate command and T120_on have been received by the gateway, it sends OpenLogicalChannelAck to the H.323 terminal and uses a flow control message to constrain the LAN->WAN data flow to match the signal MLP channel rate.
DCM (receive)	This implies that the H.323 gateway is acting as an MCU; the gateway sends RequestMode with dataMode of t120 and a DataModeProtocol of hdlcFrameTunneling. At the same time the gateway sends an MLP rate command and T120_on to the H.320 WAN side endpoint to open the MLP channel and turn on T.120.
TCS1	**No H.245 command, needed for multipoint**
TCS2	**No H.245 command, needed for multipoint**
TCS3	**No H.245 command, needed for multipoint**
AggIN*	Probably not needed
NCA-i, NCA-a, NIS, NIC, NID	Terminated at the H.323 gateway; no need for H.245 equivalent
NII	Probably not needed
NIA-s, NIQ-s, NIQ-m	Terminated at the H.323 gateway; no need for H.245 equivalent
RIR	Received if H.323 gateway is acting as a master MCU; response is either RID(no H.245 equivalent needed), or flow control messages are sent to reduce the logical channels to appropriate rates.
RID	None needed; generated by gateway toward WAN side only.
RIU	Received if H.323 gateway is acting as a master MCU; either there is no response needed if no action is to be taken, or flow control messages are sent to increase the logical channels to appropriate rates.

Table A.2 H.230 MBE command/indication	**H.245 equivalent**
TIL	**None; needed so H.323 terminal can get terminal list**
IIS	**None; needed for TCS-n response**
TIR	Probably not needed in H.245
TIP	**None; needed to get terminal id strings**
NIA	Not needed; gateway responds for H.323 terminal
NIAP	Not needed; gateway responds for H.323 terminal
AU_MAP	Probably not needed
AU_COM	Probably not needed