**ITU Telecommunication Standardization Study Group 15**

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**Experts Group for Video Coding and Systems in ATM and Other Network Environments**

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**PURPOSE:** Proposal

**TITLE : Requirements for H.Signalling Recommendation within the scope of H.323**

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## 1. Introduction

The H.320 standards is based on the underlying ISDN infrastructure. That infrastructure includes a feature rich set of signaling standards that provide all the necessary services for call set up and disconnect, line and station status (like busy, ring, ring back) and additional functions like call transfer, call forward, call waiting etc. Those ISDN standards define the signaling between Terminal Equipment and Switch (e.g. Q.931) and Switch to Switch communications (SS7).

The H.323 suite cannot rely on the assumption that the signaling services will be provided by the underlying LAN, since LAN based protocols do not provide the necessary services. To use the common telephony terms; missing are the ÒDialingÓ and ÒSignalingÓ handshakes between the ÒphoneÓ and the ÒSwitchÓ.

H.245 does not provide the functions that are necessary, since it is designed as a control set for terminal to terminal communications only as in band signaling which is part of an existing session.

We are proposing that the H.323 will include a new standard - ÒH.SignalingÓ (for lack of a better term). H.Signaling should provide the minimal set of features that are required in order to set up and terminate a call. With time, it is expected that the standard will be enhanced to provide the additional functions that will be required, for instance those functions required for Multicast (one to many) calls.

The following Chapters provide a framework for H.Signaling which is based on our current OnLAN implementation. It includes all the functions we found necessary in order to establish and maintain LAN/WAN A/V sessions. Note that Q.931 was designed for circuit switched networks and services and cannot be adopted blindly.

## 2. Definitions

**Network Device** Any device on the network that actively participates in the A/V session and is not an End Point. Examples Gatekeepers, Management /Administration Units, Switchboard Operator etc.

**Multicast** A Session where there is a single source of end point , and multiple destination end points (receive only).

# 3. Functions and Messages

H.Signaling should provide only the signaling functions between the Terminal Equipment (End Point) and the Network Device (Gateway/Gatekeeper etc.) and not the Network Device/Network Device signaling. This will guarantee that any H.323 compliant Terminal can interface with any H.323 compliant Sever (Gateway/Gatekeeper).

## 3.1. *Supported Functions*

### 3.1.1. Session related Functions

List of the minimal set of functions that need to be supported:

- Call set up- Request by a Terminal or Network Device to start a session.
- Call tear down - Request by a Terminal or Network Device to terminate a session.
- Join Request by Terminal or Network Device to join a Multicast or Multipoint Session.
- Leave Request by a Terminal or Network Device to leave a Multicast or Multipoint Session.
- Hold Request by a Terminal to stop sending and receiving without disconnecting the Session.
- Transfer Request by a Terminal to transfer the Session to another Terminal.
- Forward Request by a Terminal to forward the Call to another Terminal (on Busy or No Answer).

4.

# Establishment of Communications between H.323 terminals and Gateway

## 4.1. *Point to Point*

### 4.1.1. Terminal to Terminal within the same domain

[1]To place a call between two H.323 terminals, the calling terminal shall send a Connection Request (CRQ) message to the Gatekeeper indicating which terminal it wants to call. This connection request will include the following dynamic network addresses to be used when sending data to the caller: one for Control and DATA (H.245, H.22Z), one for audio and video. The Gatekeeper will evaluate the request based on its programmed criteria and if the call is to be allowed, forward the Connection Request to the destination terminal. If the Gatekeeper deems the call inappropriate, it will send Call ACKnowledge (CACK) to the caller with the appropriate reason for failure in the Call Status field. If the request reaches the destination terminal, it will answer the call with CACK message. The message is sent back to the Gatekeeper and from the Gatekeeper to the calling terminal. The CACK message includes the Status field that indicates whether the call is rejected and the reason for the rejection (busy, no-answer etc.) or answered. If answered , the destination provides its dynamic network addresses to the Gatekeeper. The Gatekeeper then forwards the response back to the caller.

Between the time the destination receives a Connection Request and the time it answers or rejects the call, it must periodically send a Connection In Progress (CIP) message to its Gatekeeper to update its call status (e.g. waiting for answer, one channel connected or dialing state if through Gateway, etc.). The Gatekeeper must forward all Connection In Progress messages from the destination back to the sender. The periodic sending of a Connection In Progress message allows flexibility in the callers design so that it does not have to select a fixed time-out for all calling cases. The CIP should be sent every "n" seconds, where "n" is the number of seconds the transmitter has requested in the Connection Request Message. The CIP message allows for the detection of remote system crashes during the ringing state and allows for flexibility in the time-out mechanism on the caller who needs to have time-outs for the LAN (very short), and time-outs for H.320 or H.324 calls via the Gateway (long by LAN time standards).

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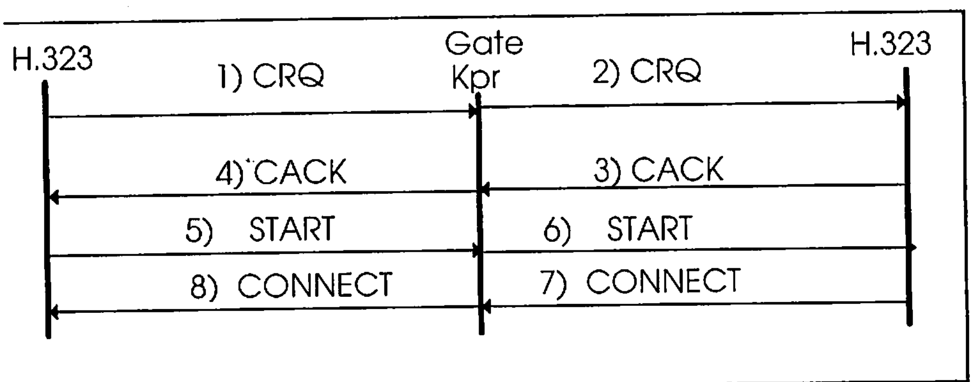
[1] Parts of this proposal is taken from Ptel-7 document

Once both sides have traded the connection messages, each knows the dynamic network addresses of where to send audio/video, control/ data. As seen from the CRQ and CACK messages the endpoints negotiates on the bandwidth of the session. The calling terminals declared the required bandwidth and the called terminal returns with a bandwidth which is either the required by the calling terminal or a smaller number if it cannot meet the requirements. Up to this stage the LAN connection between the communication layers of the H.323 terminals (including Gateway) is established.

It is possible to stop at this stage (if it is required to reserve resources for a session), or to proceed to the next step. The calling terminal sends START message in the same route as the CRQ message. The START message indicates that the called terminal may start dialing to the WAN (in case of a Gateway) or call the application (in case of a H.323 terminal). Upon connection or disconnection, the called terminal responds with CONNECT message. The CONNECT message includes a status field. At this point the calling may start sending information (probably H.245).

H.245 setup messages and the capability negotiation will begin using a guaranteed underlying protocol (TCP) on the data/control dynamic port. The capability exchange procedure follows directly from H.245. The media streams, which ride on the logical channels setup in H.245, are transported over dynamic ports using a non-guaranteed protocol (UDP).



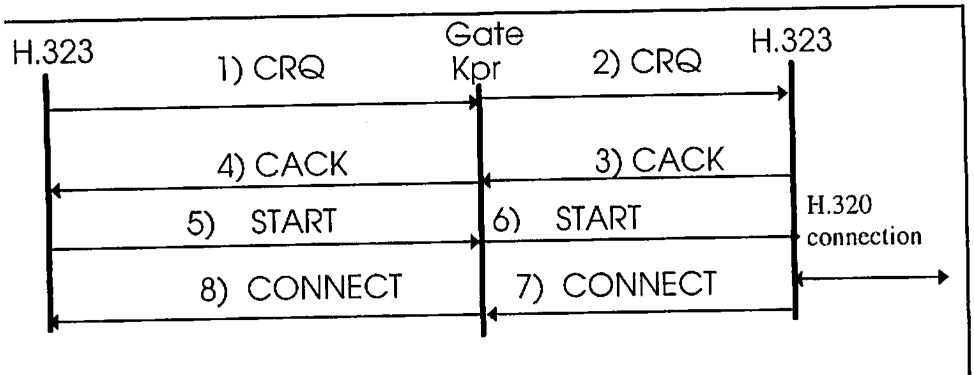

Note: Inbound calls through the Gateway work in a similar way. The Gateway becomes the initiator of the LAN call sending a Connection request to the Gatekeeper.

All messages (CRQ, CACK, START, CONNECT and CIP) are sent on the H.323 well known port using TCP. All subsequent control messages are send on the negotiated dynamic ports traded in the CRQ and CACK messages.

#### 4.1.2. Calling an H.320 end point via a Gateway within the same domain

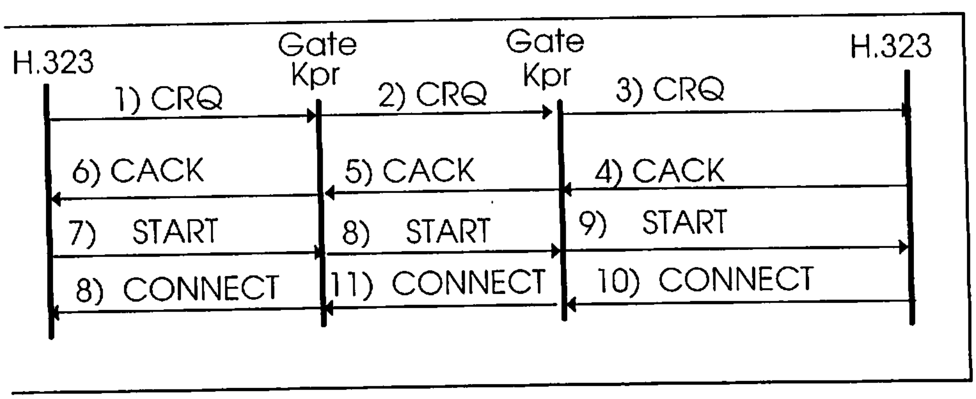
The procedure is the same as in 4.1.1 except the called terminal (the Gateway) start dialing on the WAN after it receives the START message. Upon H.320 connection on the WAN, the Gateway returns the CONNECT message. AT this stage the terminals start with frame alignment and cap-exchange.

For Inbound calls the Gateway establish full H.320 connection and then sends the CRQ message.




### 4.1.3. Terminal to Terminal in different domains

To place a call between two H.323 terminals, the calling terminal shall send a Connection Request (CRQ) message to the Gatekeeper indicating which terminal it wants to call. This connection request will include the following dynamic network addresses to be used when sending data to the caller: one for Control and DATA (H.245, H.22Z), one for audio and video. The Gatekeeper will evaluate the request based on its programmed criteria and if the call is to be allowed, forward the Connection Request to the neighbor Gatekeeper in the route to the H.323 terminal. This Gatekeeper forward the CRQ message to the next Gatekeeper and so on until it is received by the called terminal. The called terminal sends the CACK message back through the same route in opposite direction.



#### 4.1.4. Calling an H.320 end point via a Gateway in different domains

The procedure for outbound calls is the same as between terminal to terminal in different domains (section 2.1.3) with the addition that CONNECT is returned after full H.320 connection is established on ISDN. For inbound calls an H.320 connection is established before CRQ is sent from the Gateway to the Gatekeeper.

## 5.3.2 Multipoint (Multicast - many to many)

For further study

## 5.3.3 Multicast (One to Many)

For further study

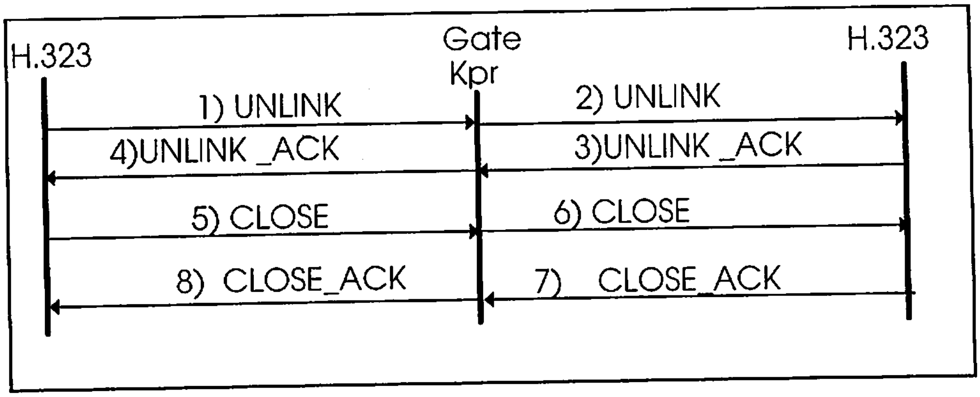
# 5. Disconnection of Communications between H.323 terminals and Gateway

### 5.1. *Point to Point*

#### 5.1.1. Terminal to Terminal within the same or different domains

Both sides may disconnect the session. The terminal that initiated the disconnection sends the UNLINK message to the Gatekeeper in its domain. The Gatekeeper sends the UNLINK to the neighbor Gatekeeper (if the two terminals are in different domains) or to the other terminal (if they are on the same domain). The receiving terminal sends the UNLINK_ACK message in the same route as the UNLINK message in opposite direction. At this stage the applications disconnect but the resources are still valid in the terminals and the Gatekeeper.

It is possible to stop here if the resources should be kept active. If not, the disconnecting terminal sends a CLOSE message to the Gatekeeper. The Gatekeeper sends the CLOSE message to the next Gatekeeper in case the terminals are in different domains or to the terminal if it is in the same domain. The terminal responds to the Gatekeeper with CLOSE_ACK. The Gatekeeper sends the CLOSE_ACK to the disconnecting terminal (or next Gatekeeper) . At this point the resources are free.




### 5.1.2. Disconnecting an H.320 end point via a Gateway within the same or different domains

For outbound sessions the H.323 initiates a disconnection as described in 5.1.1 with the UNLINK message. The Gateway disconnects the session on the ISDN as specified in the H.320 recommendation and upon completion it sends the UNLINK_ACK message back.

For Inbound disconnection, initiated by the H.320 terminal, the Gateway disconnect itself from the WAN according to the H.320 and upon completion it sends the UNLINK message to the H.323 terminal as described in 5.1.1.

## 5.3.4 Connection Request Messages

1 CALL REQUEST (CRQ)

| | | |
|---|---|---|
| Version | | Byte |
| Message Type | | Byte |
| Session Id | | 8 Bytes |
| Session Type | | Byte |
| | Point to Point | |
| | Multicast | |
| | Multipoint | |
| Quality of Service | | Byte |
| Number of Hops | | Byte |
| Source Reliable Port (TCP) | | 4 Bytes |
| Source Unreliable Port (UDP) | | 4 Bytes |
| Bandwidth | | Byte |
| Source Phone Number | | n Bytes |
| Number of Destination Phone Numbers | | Bytes |
| Destination Number #1 | | n Bytes |
| Destination Number #2 | | n Bytes |
| Destination Number #n | | n Bytes |

2 CALL_ACK (CACK)

| | | |
|---|---|---|
| Version | | Byte |
| Type | | Byte |
| Session Id | | 8 Bytes |
| Number of Hops | | Byte |
| Destination Reliable Port (TCP) | | 4 Bytes |
| Destination Unreliable Port (UDP) | | 4 Bytes |
| Bandwidth | | 1 Byte |
| Call Status | | 1 Byte |
| | OK | |
| | No Resources | |
| | Fail | |

3 START

| | | |
|---|---|---|
| Version | | Byte |
| Type | | Byte |

4 CONNECT

| | | |
|---|---|---|
| Version | | Byte |
| Type | | Byte |
| Status | | Byte |
| | Busy | |
| | No-answer | |

5 UNLINK

| | |
|---|---|
| Version | Byte |
| Type | Byte |

6 UNLINK_ACK

| | |
|---|---|
| Version | Byte |
| Type | Byte |

7 CLOSE

| | |
|---|---|
| Version | Byte |
| Type | Byte |

8 CLOSE_ACK

| | |
|---|---|
| Version | Byte |
| Type | Byte |

## 6. Network Device / Network Device Signaling

By Network Device / Network Device we mean any network side A/V device which participates in the Session.

We propose that Network Device - Network Device signaling will not be included in this standard.