INTERNATIONAL TELECOMMUNICATION UNION

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

H.283

(05/99)

SERIES H: AUDIOVISUAL AND MULTIMEDIA SYSTEMS

Infrastructure of audiovisual services – Related systems aspects

---

Remote device control logical channel transport

ITU-T Recommendation H.283

(Previously CCITT Recommendation)

ITU-T H-SERIES RECOMMENDATIONS

AUDIOVISUAL AND MULTIMEDIA SYSTEMS

Characteristics of transmission channels used for other than telephone purposes	H.10–H.19
Use of telephone-type circuits for voice-frequency telegraphy	H.20–H.29
Telephone circuits or cables used for various types of telegraph transmission or simultaneous transmission	H.30–H.39
Telephone-type circuits used for facsimile telegraphy	H.40–H.49
Characteristics of data signals	H.50–H.99
CHARACTERISTICS OF VISUAL TELEPHONE SYSTEMS	H.100–H.199
INFRASTRUCTURE OF AUDIOVISUAL SERVICES	
General	H.200–H.219
Transmission multiplexing and synchronization	H.220–H.229
Systems aspects	H.230–H.239
Communication procedures	H.240–H.259
Coding of moving video	H.260–H.279
Related systems aspects	**H.280–H.299**
Systems and terminal equipment for audiovisual services	H.300–H.399
Supplementary services for multimedia	H.450–H.499

For further details, please refer to ITU-T List of Recommendations.

ITU-T RECOMMENDATION H.283

REMOTE DEVICE CONTROL LOGICAL CHANNEL TRANSPORT

Summary

This Recommendation describes the logical channel transport to carry the remote device control protocol for multimedia applications (Recommendation H.282) for use with systems that use packet switched networks, such as those according to Recommendation H.323.

This Recommendation describes the logical channel transport (LCT) services and protocol. LCT can carry H.282 protocol in an H.323 point-to-point or multipoint conference. LCT is used within a bidirectional, unreliable H.245 logical channel. LCT provides the following services, accessed at its service access point:

- managing the Node List of all RDC participants in the conference;
- exchange of H.282 device list capability information;
- sending and receiving H.282 protocol messages between nodes.

Source

ITU-T Recommendation H.283 was prepared by ITU-T Study Group 16 (1997-2000) and was approved under the WTSC Resolution No. 1 procedure on 27 May 1999.

FOREWORD

ITU (International Telecommunication Union) is the United Nations Specialized Agency in the field of telecommunications. The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of the ITU. The ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Conference (WTSC), which meets every four years, establishes the topics for study by the ITU-T Study Groups which, in their turn, produce Recommendations on these topics.

The approval of Recommendations by the Members of the ITU-T is covered by the procedure laid down in WTSC Resolution No. 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

NOTE

In this Recommendation the term *recognized operating agency (ROA)* includes any individual, company, corporation or governmental organization that operates a public correspondence service. The terms *Administration, ROA* and *public correspondence* are defined in the *Constitution of the ITU (Geneva, 1992)*.

INTELLECTUAL PROPERTY RIGHTS

The ITU draws attention to the possibility that the practice or implementation of this Recommendation may involve the use of a claimed Intellectual Property Right. The ITU takes no position concerning the evidence, validity or applicability of claimed Intellectual Property Rights, whether asserted by ITU members or others outside of the Recommendation development process.

As of the date of approval of this Recommendation, the ITU had not received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementors are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database.

CONTENTS

Recommendation H.283

REMOTE DEVICE CONTROL LOGICAL CHANNEL TRANSPORT

(Geneva, 1999)

1 Scope

This Recommendation describes the logical channel transport to carry the remote device control protocol for multimedia applications for use with systems that use packet switched networks. See Figure 1.

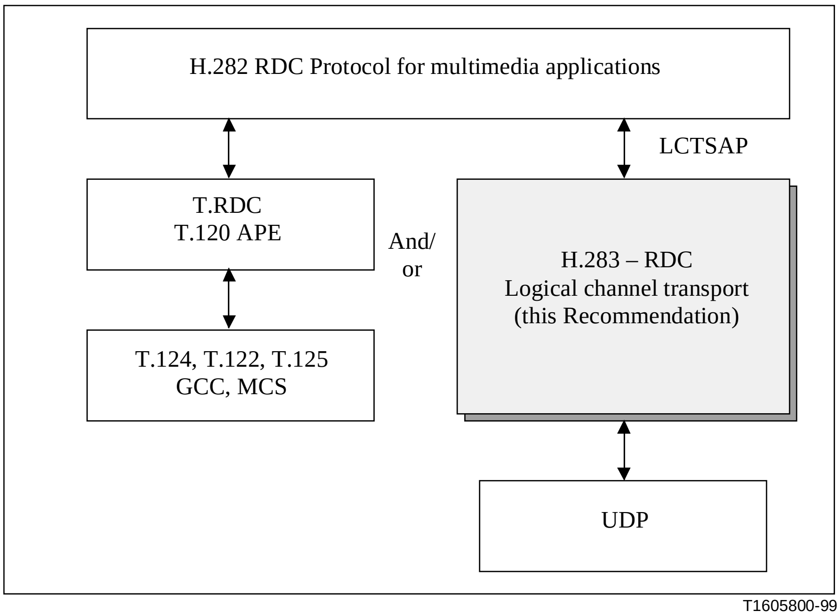

Figure 1/H.283 – Remote device control stack

Recommendation H.282 describes the RDC protocol for multimedia applications, which provides the core services and protocol for performing configuration and control of a remote device during a multimedia conference. A number of standard devices are defined allowing a node to model a peripheral device such as for example a camera, microphone, VCR or slide projector, or non-standard devices. This model is presented to the other nodes in the conference to allow these nodes to perform remote control.

This Recommendation describes the Logical Channel Transport (LCT) services and protocol. LCT can carry H.282 protocol in an H.323 point-to-point or multipoint conference. LCT is used within a bidirectional, unreliable H.245 logical channel. LCT provides the following services, accessed at its service access point:

- managing the Node List of all RDC participants in the conference;
- exchange of H.282 device list capability information;
- sending and receiving H.282 protocol messages between nodes.

2 Normative references

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; all users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published.

– ITU-T Recommendation H.245 (1998), *Control protocol for multimedia communications.*

– ITU-T Recommendation H.282 (1999), *Remote device control protocol for multimedia applications*.

– ITU-T Recommendation H.323 (1998), *Packet-based multimedia communications systems*.

– ITU-T Recommendation X.680 (1997) | ISO/IEC 8824-1:1998, *Information technology – Abstract Syntax Notation One (ASN.1): Specification of basic notation.*

– ITU-T Recommendation X.691 (1997) | ISO/IEC 8825-2:1998, *Information technology – ASN.1 encoding rules: Specification of packed encoding rules (PER)*.

3 Definitions

This Recommendation defines the following terms:

3.1 Common RDC: The part of RDC that is common to both T.120 and H.323, called H.282 – RDC protocol for multimedia applications. This is the upper layer protocol, which is carried by either T.RDC or LCT.

3.2 LCT service access point: The communication interface between an LCT provider and an RDC protocol for multimedia applications entity within a single node.

3.3 Node List: A list of nodes maintained by an LCT provider. The node list contains an entry for each node that is part of the RDC session. Each node in the list is identified by its <M><T> address.

3.4 RDC connection: A single bidirectional logical channel used for RDC with LCT.

3.5 RDC session: A set of endpoints communicating with each other over RDC connections. There is at most one RDC session per audio/video/data conference.

4 Symbols and abbreviations

This Recommendation uses the following abbreviations:

LCT	The logical channel transport to carry common RDC in an H.323 multipoint or point-to-point call
LCTSAP	Logical channel transport service access point
RDC	Remote device control
T.RDC	The T.120 APE to carry common RDC
UDP	User datagram protocol

5 Conventions

In this Recommendation, the following conventions are used:

– "Shall" indicates a mandatory requirement.

– "Should" indicates a suggested but optional course of action.

– "May" indicates an optional course of action rather than a recommendation that something take place.

The primitive parameters of the abstract services defined in this Recommendation use the following key:

M Parameter is mandatory.

C Parameter is conditional.

O Parameter is optional.

Blank Parameter is absent.

(=) Value of the parameter is identical to the value of the corresponding parameter of the preceding primitive, where preceding is defined relative to the order: request, indication, response, confirm.

Primitives are categorized in up to four types: request, indication, response, and confirm. Some primitives support all of these types, while others do not. These four types are defined as follows:

Request primitive: Those that are sourced from a common RDC application to initiate a certain action.

Indication primitive: Those that are sourced from an LCT service provider either as a result of a request primitive, or as a result of an LCT service provider initiated action.

Response primitive: Those that are sourced from a common RDC application in response to an indication primitive which is defined to require a response.

Confirm primitive: Those that are sourced from an LCT service provider as a result of a request or response primitive.

6 RDC logical channel transport overview

RDC LCT provides services to the RDC protocol for multimedia applications, as shown in Figure 1, Remote device control stack. LCT provides the means for the upper layer RDC to communicate with its peer RDC nodes in a point-to-point or multipoint conference.

LCT runs in bidirectional unreliable H.245 logical channels. It provides an unreliable and a reliable service. The reliable service is intended for the low bandwidth traffic of RDC, not high bandwidth streaming data.

An RDC session within a conference consists of all the nodes in a conference with active RDC connections. There are many ways in which RDC connections can be set up between nodes in a conference, depending on centralized, decentralized and multicast capability. This is described further in 8.3, Multipoint channels. Each node may have more than one RDC connection, but in any case all the connections are part of the same session. Control of multiple devices and multiple device types is handled within a single instance of the RDC protocol.

The services provided by LCT are described in clause 7, Logical channel transport service definition.

Clause 8, Logical channel transport protocol, defines the packet format, acknowledgement and retransmission protocol, addressing considerations and capability exchange.

7 Logical channel transport service definition

This clause describes the service interface of LCT, the LCTSAP. This service interface is used by an RDC application which uses the common RDC protocol.

NOTE – The normative intent of this Recommendation is to specify the procedures and contents of external communication – sequences of data exchanges on the logical channel for purposes of remote device control. The internal decomposition of a node suggested in Figure 1 serves to motivate features of the LCT protocol but is not normative. LCT service primitives whose effect is purely local need not exist at all nodes in the form that they are described here. Statements about what an LCT provider shall do in certain circumstances should be interpreted loosely if the same results in external communication can be achieved through different internal mechanisms.

7.1.1 Service primitives

Primitives for obtaining a list of other LCT nodes in the conference:

– NodeList.indication,

– NodeList.request,

– NodeList.confirm.

Primitives for exchanging device list capability information:

– GetDeviceList.request,

– GetDeviceList.indication,

– GetDeviceList.response,

– GetDeviceList.confirm,

– DeviceListChange.request,

– DeviceListChange.indication.

Primitives for sending and receiving common RDC messages:

– SendData.request,

– SendData.indication.

7.1.2 Node list

An application uses the NodeList.request primitive to obtain a list of other LCT nodes in the conference. The LCT service provider issues a NodeList.indication primitive any time there is a change in the node list. An application can use the NodeList.request primitive at any time, not only in response to a NodeList.indication. See Figure 2 and Table 1.

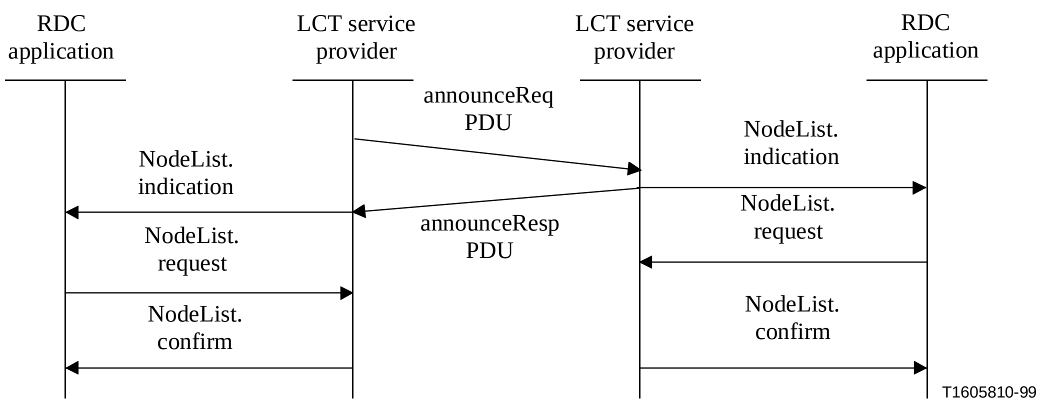

Figure 2/H.283 – NodeList – Sequence of primitives

Table 1/H.283 – NodeList

Content	Request	Indication	Confirm
Node List			M

Node List: A list of <M><T> addresses, one for each other LCT node in the conference.

7.1.3 Device list

An RDC application uses the GetDeviceList.request primitive to get the list of another node's devices. This device list is fully described in common RDC. It is a list of devices that are available for control or source selection.

Whenever an RDC application's own device list changes, or the capabilities of a specific device it owns changes, the application shall issue a DeviceListChange.request primitive. The LCT service provider will then notify other nodes of the change. See Figure 3 and Table 2.

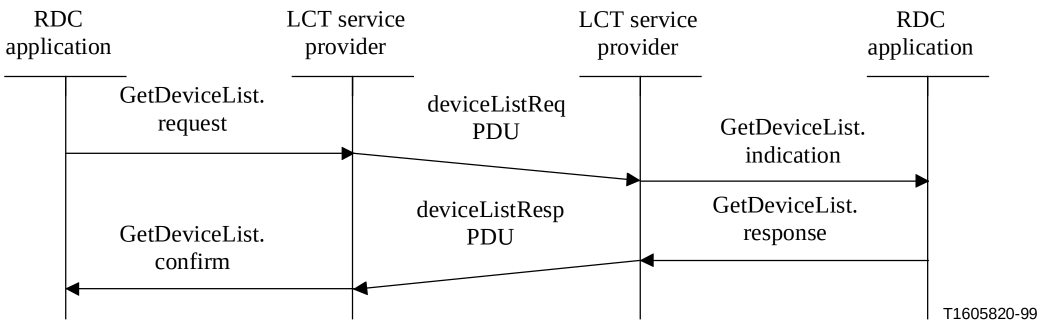

Figure 3/H.283 – GetDeviceList – Sequence of primitives

Table 2/H.283 – GetDeviceList

Content	Request	Indication	Response	Confirm
Requesting node address		M	M(=)	
Device owner address	M			M
Device list			O	O(=)

Requesting node address: The <M><T> address of the node that makes the request.

Device owner address: The <M><T> address of the node that owns the devices.

Device list: The list of devices and streams available at the responding node. The format of the device list is defined by common RDC, using the NonCollapsingCapabilities structure defined in the common RDC PDU definitions. If this parameter is absent, it means the node has no RDC devices. See Figure 4 and Table 3.

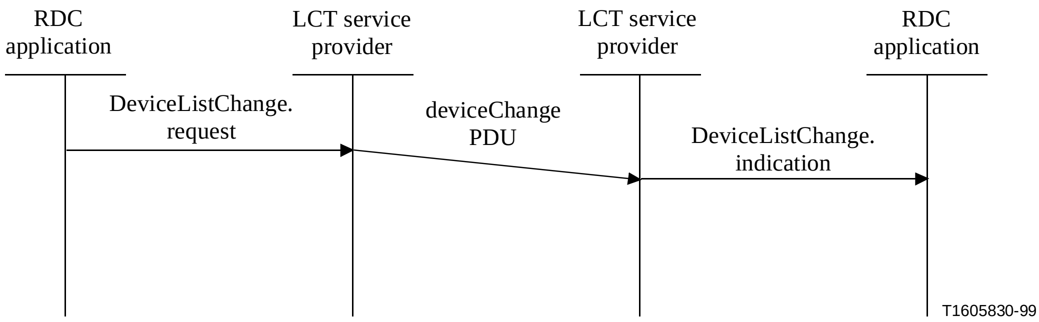

Figure 4/H.283 – DeviceListChange – Sequence of primitives

Table 3/H.283 – DeviceListChange

Content	Request	Indication
Requesting node address		M

Requesting node address: The <M><T> address of the node that makes the request.

7.1.4 Send data

See Figure 5 and Table 4.

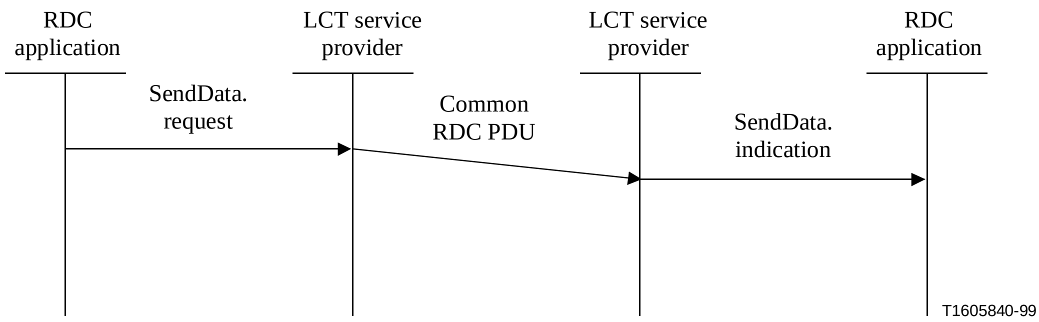

Figure 5/H.283 – SendData – Sequence of primitives

Table 4/H.283 – SendData

Content	Request	Indication
Reliable flag	M	M(=)
Destination node address	M	
Source node address		M
Application data	M	M(=)

Reliable flag: Flag indicating if this data shall be sent reliably or with low latency.

Destination node address: The <M><T> address of the destination node.

Requesting node address: The <M><T> address of the node that makes the request.

Application data: The data to be sent. The format of this data is defined by common RDC.

8 Logical channel transport protocol

This clause describes the detailed packet format, acknowledgement and retransmission rules, addressing, and capability exchange.

8.1 Packet format

The packet format has the following characteristics:

- an LCT header containing addressing, sequence number, timestamp, and means for a receiver to acknowledge a packet;
- a payload consisting of either an LCT protocol message or an RDC PDU.

See Figure 6.

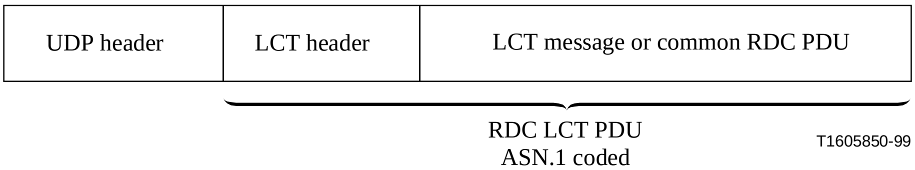

Figure 6/H.283 – LCT packet format

8.1.1 LCT header

Refer to 8.5, Syntax, for the ASN.1 description of LCT syntax.

Each **LCTPDU** is either an **ack** packet or an **rdcData** packet. Every **LCTPDU**, both **ack** and **rdcData**, have header information including the <M><T> source address **srcAddr**, the <M><T> destination address **dstAddr**, a **timestamp** timestamp in milliseconds, and a sequence number **seqNumber**.

The sequence number is incremented by one for each data packet sent, regardless of destination address. The initial value of the sequence number is a local matter.

The timestamp of a data PDU represents the time it is initially sent. Timestamps on data packets shall increment monotonically and linearly in time to allow jitter compensation. The initial value of the timestamp is a local matter.

The usage of sequence numbers and timestamps in **ack** packets and retransmitted data packets is described in 8.2, Acknowledgement, retransmission and duplicates.

Each **rdcData** packet has additional header information in the **RDCData** field. There is a **reliable** field, indicating if the packet must be acknowledged by the receiver.

8.2 Acknowledgement, retransmission and duplicates

For any data packet, the sender can specify whether or not the packet should be retransmitted until it is acknowledged by the receiver.

The acknowledgement is sent by the RDC endpoint, not by any intermediate nodes such as MCUs. In the case of a gateway translating between RDC and H.224/H.281 in H.320 or H.324, then the gateway shall send the acknowledgement.

Each LCTPDU can be either an **ack** packet or an **rdcData** packet. Ack packets are sent only in response to an rdcData packet that has **reliable** set to true in the **RDCData** sequence. Packets sent to the <M><T> broadcast address of <0><0>, when in a multipoint call, shall have **reliable** set to false. Ack packets shall have a sequence number identical to the sequence number of the data packet being acknowledged. Ack packets shall have a timestamp identical to the timestamp of the data packet being acknowledged.

The sender decides whether or not a packet should be reliable. Typically, all non-broadcast packets are reliable, except for messages that require minimum latency such as camera control start/stop packets.

A receiver shall send an **ack** packet upon receipt of an **rdcData** packet with **reliable** set to true and a **dstAddr** that matches the receiver's own <M><T> address. The receiver shall send the acknowledgment within 50 milliseconds of receiving the data packet. The receiver shall send the acknowledgment regardless of the sequence number. That is, the receiver shall send the acknowledgment even if the received data packet is a duplicate.

If a sender does not receive an acknowledgment during the retransmission timeout period, the sender shall retransmit the data packet, using the same sequence number and timestamp as the original data packet. The retransmission timeout period should be 50 milliseconds plus the estimated round trip delay. The timestamp in ack packets can be used to estimate the round trip delay. Determination of the exact value of the timeout period is a local matter.

Only one reliable data packet at a time can be outstanding to a particular <M><T> destination. If a sender of a reliable data packet has not yet received an acknowledgment, that sender shall not send any additional (that is, with a new sequence number) reliable data packets to the same <M><T> destination. A sender may send an unreliable (Ack not requested) packet without first receiving an Ack for the previous reliable packet. A sender may send a reliable packet to a different <M><T> destination without first receiving an Ack for a previous reliable packet to another destination.

If a data packet with a duplicate sequence number and timestamp from the same <M><T> source address is received, the receiver shall acknowledge it as described above and discard the duplicate data packet.

A receiver shall expect sequence numbers to increase by 1 or more for each packet received from a particular source. If a particular sequence number does not arrive, it does not necessarily indicate a lost packet because the sender could have sent that sequence number to some other destination.

If a receiver receives an out of order reliable packet, identified by a sequence number less than the most recently received sequence number from that particular source address, then the receiver shall act on the out of order packet as normal. Note that reliable packets can never be out of order with respect to other reliable packets. But it is possible for a reliable packet to be out of order with respect to unreliable packets.

If an unreliable packet is received out of order, identified by a sequence number less than the most recently received sequence number from that particular source address, the receiver shall discard the unreliable out of order packet without acting on it.

A sender may intentionally send duplicate copies of unreliable packets, with identical timestamp and sequence number, to protect against possible packet loss. For example, **announceReq** and **deviceChange** messages may be duplicated in this manner.

8.3 Multipoint channels

8.3.1 Addressing

Terminal numbering according to the procedures in H.243 is required in order to support the data link layer in multipoint . The MCU/Terminal address pair <M><T> is used to uniquely identify each terminal in a conference. The special destination address of <0><0> is the broadcast address. The special source address <0><0> indicates the sender does not know its address. An address with the terminal number set to 0 indicates the MC, such as <*n*><0> indicates MC number *n.*

Note that an MCU can be the source or destination of data link messages. An MCU, for example, can host a device that can be controlled by RDC.

In a point-to-point call, when only two terminals are involved, then the terminals do not have an <M><T> address. In this case, the <M><T> source and destination addresses are always <0><0>. The **reliable** field may be set to true in this point-to-point case, even though address <0><0> is used.

8.3.2 Centralized

See Figure 7.

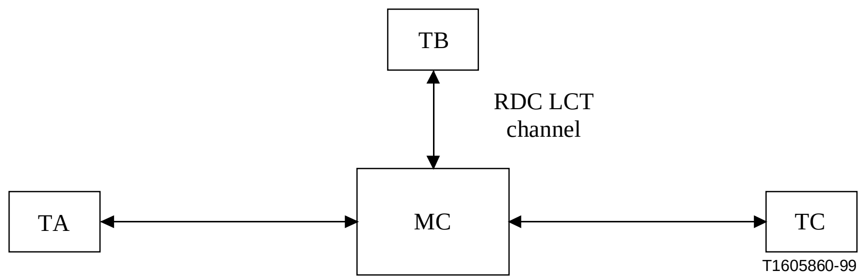

Figure 7/H.283

An LCT connection is opened between each terminal and the MC. When a terminal sends an LCT/RDC packet, the MC shall forward the packet to the destination node. The MC may do this by retransmitting each packet to all other connected nodes that support LCT/RDC. Or the MC may selectively retransmit each packet only toward the destination node, as indicated by the <M><T> address in the header.

8.3.3 Decentralized multicast

See Figure 8.

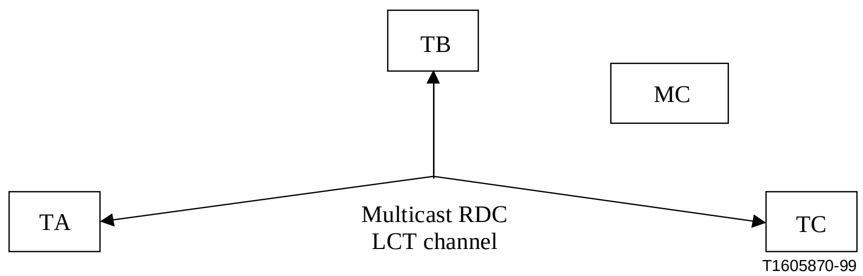

Figure 8/H.283

LCT can be used in a decentralized manner, such that each node multicasts its LCT channel to other nodes. This is similar to the centralized mode, in that each terminal has only one logical channel for LCT/RDC. In this situation, the MC is not involved in forwarding LCT/RDC packets because each terminal belongs to the same logical channel. The MC could belong to the LCT channel also, and be a node in the RDC session, if the MC needs to run RDC to control or host an RDC device.

8.3.4 Decentralized multi-unicast

See Figure 9.

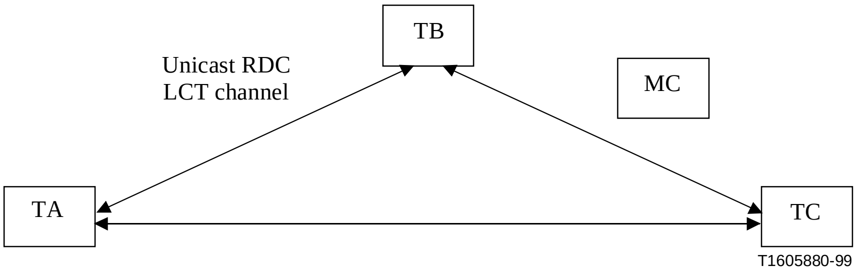

Figure 9/H.283

In this situation, each terminal has a separate RDC LCT logical channel to each other terminal. When an LCT node sends a packet to a particular node, it should send that packet only on the single logical channel that is connected to the destination node.

8.3.5 Hybrid

A multipoint conference can have RDC LCT connections using a hybrid of centralized and decentralized modes. When an RDC LCT node sends a packet to a particular node, it should send that packet only on the single logical channel on which the destination node is reachable.

8.4 Capability exchange

There are several levels of capabilities:

- LCT/RDC capability;
- if a node has LCT/RDC capability, then there is a list of devices supported by that node;
- for each device, there are specific device capabilities.

Each of these types of capability is handled by a different layer of the protocol.

8.4.1 LCT/RDC capability

H.245 is used to signal H.283 capability. The **receiveAndTransmitDataApplicationCapability** part of the **Capability** choice shall be used to indicate H.283 capability.

receiveDataApplication Capability and **transmitDataApplicationCapability** shall not be used to indicate H.283 capability.

The **GenericCapability** part of the **DataApplicationCapability** sequence shall be used to indicate H.283 capability as described in Table 5.

Table 5/H.283 – Capability identifier

Capability name	ITU-T Recommendation H.283
Capability class	Data protocol
Capability identifier type	Standard
Capability identifier value	itu-t(0) recommendation(0) h(8) 283 generic-capabilities (1) 0
Capability parameter type	No parameters
maxBitRate	Not used

8.4.2 Node list management

Whenever a node opens a LCT channel, it shall broadcast an **announceReq** message on that connection. Each other node reachable via that connection shall respond to the sender with an **announceResp** message. An **announceResp** message shall have **reliable** set to true. In this way, the node that just opened the channel learns of the existence of all other LCT nodes that are reachable on that channel. Likewise, each existing node learns of the existence of the new node.

When a terminal receives an H.245 **terminalLeftConference** indication, it shall remove the indicated node from the LCT Node List. No further RDC or LCT messages should be sent to that node. A node may send **announceReq** at any time.

8.4.3 Device list exchange

The list of devices is exchanged using **LCTRequest** and **LCTResponse** messages.

After learning of the existence of other LCT nodes, a node may send an **LCTRequest** message of type **deviceListReq** to any other LCT node. This message shall have **reliable** set to true. The receiving node shall respond with a **LCTResponse** message using the **deviceListResp** field to contain a device list. The format of this data is defined in common RDC. This message shall have **reliable** set to true.

When a node's local device list changes, for example a new device is added, that node shall broadcast an **LCTIndication** using **deviceChange** on all LCT connections. Any other LCT node that is interested in this event may then use a **deviceListReq** message to request the new device list.

8.4.4 Specific device capabilities

The exchange of specific device capabilities is done with common RDC PDUs, for example **DeviceAttributeRequest** and **DeviceAttributeResponse** messages, as described in common RDC.

8.5 Syntax

```
LCT-PROTOCOL {itu-t recommendation h 283 version (0) 1} DEFINITIONS AUTOMATIC TAGS ::=

BEGIN

H221NonStandard                 ::= SEQUENCE
{
        t35CountryCode          INTEGER(0..255), -- country, as per Recommendation T.35
        t35Extension            INTEGER(0..255), -- assigned nationally
        manufacturerCode        INTEGER(0..65535), -- assigned nationally
}

NonStandardIdentifier           ::= CHOICE
{
        object                  OBJECT IDENTIFIER,
        h221NonStandard         H221NonStandard,
        ...
}
```

```
NonStandardParameter              ::= SEQUENCE
{
        nonStandardIdentifier     NonStandardIdentifier,
        data                      OCTET STRING
}

LCTPDU                            ::= SEQUENCE
{
        srcAddr                   MTAddress,
        dstAddr                   MTAddress,
        timestamp                 INTEGER(0..4294967295), -- milliseconds
        seqNumber                 INTEGER(0..65535),
        pduType                   CHOICE
        {
                ack               NULL,
                rdcData           RDCData
        },
        nonStandardParameters     SEQUENCE OF NonStandardParameter OPTIONAL,
        …
}

MTAddress                         ::= SEQUENCE
{
        mAddress                  INTEGER (0..65535),
        tAddress                  INTEGER (0..65535)
}

RDCData                           ::= SEQUENCE
{
        reliable                  BOOLEAN,
        dataType                  CHOICE
        {
                lctMessage        LCTMessage,
                rdcPDU            OCTET STRING          -- Common RDC PDU
        },
        …
}

LCTMessage                    ::= CHOICE
{
        lctRequest                LCTRequest,
        lctResponse               LCTResponse,
        lctIndication             LCTIndication,
        nonStandardMessage        NonStandardMessage,
        …
}

LCTRequest                        ::= CHOICE
{
        announceReq               NULL,
        deviceListReq             NULL,
        …
}

LCTResponse                       ::= CHOICE
{
        announceResp              NULL,
        deviceListResp            OCTET STRING,         -- Common RDC
        …
}

LCTIndication                 ::= CHOICE
{
        deviceChange          NULL,
        …
}
```

```
NonStandardMessage          ::= SEQUENCE
{
    nonStandardParameters   SEQUENCE OF NonStandardParameter OPTIONAL,
    …
}

END
```

9 Use of common RDC

This clause describes the usage of common RDC in H.323 with LCT.

Common RDC describes a conducted mode of operation. For use with LCT, conducted mode usage is for further study.

The issue of identifying a stream for source selection (connecting an audio or video source to a stream sent to other nodes) is related to the issue of how to select a device to control. There needs to be a means for a controlling node to identify which device it wants to control. Typically, a controller wants to control the device that is sourcing a stream currently being received by the controller. There could be multiple streams and multiple nodes in the conference, so there needs to be a way to identify which device at which node is sourcing a particular stream that is being received by a particular terminal.

The H.245 **terminalYouAreSeeing** indication should be used to identify which remote node is the source of a particular video stream. The TerminalLabel in the indication contains the <M><T> address of the sourcing node.

Common RDC uses numeric stream identifiers to identify audio and video streams sourced from a terminal. The use of these identifiers to distinguish among multiple streams from the same terminal is for further study.

ITU-T RECOMMENDATIONS SERIES

Series A	Organization of the work of the ITU-T
Series B	Means of expression: definitions, symbols, classification
Series C	General telecommunication statistics
Series D	General tariff principles
Series E	Overall network operation, telephone service, service operation and human factors
Series F	Non-telephone telecommunication services
Series G	Transmission systems and media, digital systems and networks
Series H	**Audiovisual and multimedia systems**
Series I	Integrated services digital network
Series J	Transmission of television, sound programme and other multimedia signals
Series K	Protection against interference
Series L	Construction, installation and protection of cables and other elements of outside plant
Series M	TMN and network maintenance: international transmission systems, telephone circuits, telegraphy, facsimile and leased circuits
Series N	Maintenance: international sound programme and television transmission circuits
Series O	Specifications of measuring equipment
Series P	Telephone transmission quality, telephone installations, local line networks
Series Q	Switching and signalling
Series R	Telegraph transmission
Series S	Telegraph services terminal equipment
Series T	Terminals for telematic services
Series U	Telegraph switching
Series V	Data communication over the telephone network
Series X	Data networks and open system communications
Series Y	Global information infrastructure and Internet protocol aspects
Series Z	Languages and general software aspects for telecommunication systems