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 : H.261 Video Payload for H.323

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1. Scope

The purpose of this document is to propose how H.261 video streams shall be carried on H.22Z.

The H.323 defines two main components that are involved in video communication: the Terminal and the Gateway. Therefore, the H.261 PDU structure should meet the requirements for Terminal to Terminal, Gateway to Terminal and Terminal to Gateway communications.

2. References

1. ITU-T Recommendation H.261 (1993) - Video codec for Audiovisual services at p x 64 kbit/s
2. draft-ietf-avt-h261-01.txt by Thierry Turletti, July 10 1995
3. RTP Packetization of H.261 Video Stream by Thierry Turletti, March 8, 1995

3. Requirements

The purpose of the PDU is to carry the H.261 bit stream from:

- An H.323 terminal to another H.323 terminal
- An H.323 terminal to Gateway and to H.320/H.324/H.321 terminals
- An H.323 Gateway to H.323 terminal.

The reason for distinguishing between a terminal and a gateway is because the terminal contains the codec which is the ultimate source and destination of the video bit-stream and therefore possesses the processing power, either by hardware or software, to process the video bit stream. The gateway is a communications device. Its purpose is to interface between two different communication networks.

The question is what is the basic unit for the H.261 PDU..

4. Basic Video PDUs

The Video PDU(s) are sent over H.22Z frame (*e.d - I preferred the term frame and not packet to distinguish between network layer packet and H.22Z "packet"*).

It was previously suggested that the basic unit should be the Group Of Blocks (GOB) as defined in [1]. It was based on the work done by the IETF with some changes. Meantime the IETF [2] proposed to add a different basic unit - the Macro Block (MB) as defined in [1]. The suggestion is that a unit with integer number of GOBs will be sent whenever it is smaller than one packet (*e.d - I assume network packet*) and an integer of MB(s) is sent when one GOB exceeds the packet size. A previous version of the IETF document [3] defines the GOB as the only basic unit.

The reason for the change between the two IETF proposals is to decrease the effect of packet loss. By sending MB (with additional information) it is possible to reconstruct the received MB while in a GOB that is split between two packets and one of them is lost , the other packet should be discarded as well.

The following sections summarize the advantages and disadvantages of each unit type.

4.1. Macro Block (MB) Unit

4.1.1. The transmitter

The transmitter finds the beginning of each MB and adds some information to the unit header to enable the reconstruction of the MB, if the previous MB(s) are lost. [2].

4.1.2. The receiver

Upon receiving of a packet with MB unit(s) the receiver checks if the previous packet has arrived. If it arrived, the special header of the MB is discarded and the MB(s) are forwarded to the video decoder. If the previous packet was lost, the MB header is reconstructed from the unit header and is forwarded to the decoder.

4.1.3. Advantages

- The work with MB enables lower delay, the transmitter waits less before it sends a unit.
- All the received MB can be processed by the decoder.

- A reconstructed MB does not guarantee that there will be no artifacts on the screen but it minimizes it.

4.1.4. Disadvantages

- For Hardware coders, there must be a special mode to find the MB boundaries
- It adds computational load on the transmitter to build the unit header. It must locate the last MB in the previous packet and calculate the unit header. For the Gateway, which has no H.261 "knowledge' this is a significant task.
- The receiver needs to calculate the MB parameters from the unit header when a packet is lost.
- There is a need to add fill bits in the same number of the lost bits in order to keep the same delay. Because MB size is not a fixed number of bits, it is required to add to the unit header the total number of bits (from the beginning of the session). Here again, the problem is the need for additional computations.
- There is a link between the network layer (size of a packet), the "session" layer (H.22Z) and the application (the H.261). This is a major disadvantage.
    - This may work with software codecs but it is very difficult for hardware codecs and especially for the Gateway since the Gateway does not have the application capabilities.
    - The underlying protocol (i.e. UDP/IP) is responsible for mux/demux of H.22Z payloads , so the H.22Z layer does not know the size of the network packet.

4.2. Group Of Block (GOB) Unit

4.2.1. Transmitter

The transmitter has to search for the GOB header and transmit the information up to that header. It is possible to combine several GOBs in one H.22Z frame. If a GOB is larger than one H.22Z frame it is fragmented by the underlying protocol (UDP).

4.2.2. Receiver

Receives the H.22Z frame and forwards it to the video decoder in a terminal or to the BCH processor in the Gateway. GOB(s) in lost packets are discarded. There is no

attempt to reconstruct it. If a packet contains partial GOB and the full GOB can't be reconstructed the whole GOB is discarded.

4.2.3. Advantage

Simple to implement. It is relatively easy to find the GOB header.

4.2.4. Disadvantage

- size of a GOB may exceed the H.22Z frame size and that means fragmentation of the GOB into more than one packet. Partial GOB information is discarded. This may cause more screen artifacts.(than in MB)

- There is a need to add fill bits in the same number of the lost bits in order to keep the same delay. Because GOB size is not fixed number of bits it is required to add to the unit header the total number of bits (from the beginning of the session).

5. Conclusions and Recommendations

It is clear from the above that there is not one best solution. Better quality requires more processing power. We recommend to allow the two possibilities. Terminals/Gateway should negotiate at the beginning of the session (as in cap exchange) and determine what should be the video PDU structure. We also need to remember that, to date, there is insufficient experience in Videoconferencing over non-guaranteed QoS LANs.

The idea is to require that every H.323 device (terminal or gateway) will - as a minimum support - the GOB , and negotiate with the other terminal for MB.

It is important to mention that the decision should not be based on the type of connection only (terminal to terminal etc.) but to the performance of the network. If the network is well immuned to packet loss (the load is low, use of switched Ethernet etc.) there is no need to go to MB PDU. It should be remembered that we are dealing with well controlled network and not the entire Internet.

The exact format of the payload is defined in [2] and [3]. There is a need to make some small changes (adding byte (bit) count) that is needed for the constant bit rate network and it was required for LAN only communication.