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Title: Frame structure and communications procedure for m x 64 kbps video telephony

Abstract

A communications procedure is proposed for m x 64 kbps video telephony operating on a circuit switched network. The lower layer performs error correction and synchronization between multiple 64 kbps channels using a fixed length packet format. The higher layer provides a flexible bit allocation between video, audio, and data using a variable length packet format. A procedure to negotiate parameters for a video session is also defined.

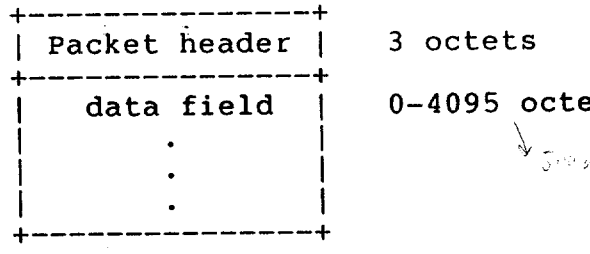

Figure 1. Higher layer variable length packet format.

1 HIGHER LAYER PACKET FORMAT

The higher layer performs multiplexing of video, audio, and data into a single bit stream. A variable length packet format is used. The packet format consists of header and information as outlined in Fig. 1.

Every packet starts with a sync octet. The Type field identifies the packet as Video, Audio, or Data. The Length field indicates the length of the data field in octets. The data field can be between 0 and 4095 octets, i.e., up to 32760 bits.

2 LOWER LAYER PACKET FORMAT

The lower layer provides the following functions:

- o Synchronization of multiple channels
- o Error correction
- o Encryption
- o Means for transmitting control information for parameter negotiation and other supervisory information.

A fixed length packet format is used. The format was introduced in Doc. 171 (Nov. 1986). It is outlined in Fig. 2 and consists of 255 octets. Each octet is transmitted with the least significant bit first. The sync word is a unique pattern which is used to mark the beginning of the packet. The end of packet is always known because all packets are of fixed length. Bit times between packets if present are filled with ones.

There are two types of packets: control packets and data packets. The high order bit, i.e., the last transmitted bit, in the control field is set to one to indicate a control packet. In this case, the low order seven bits are interpreted as a control packet type. In the case of a data packet, the seven bits form a sequence number. Sequence numbers of successive data packets are assigned by incrementing modulo 128.

The forward error correction scheme uses a double error correcting Reed-Solomon code over GF(256). It generates 4 octets of parity, and it allows a maximum blocklength of 255 octets. The data field is chosen to be 248 octets; a multiple of 64 bits gives compatibility with DES encryption.

The parity is calculated based on the contents of the control and data fields. The receiving terminal calculates syndromes based on the control, data and parity fields which

will tell whether zero, one, two or more integral octets in the packet were subjected to transmission errors. If only one or two octets are in error, they may be located and corrected. A larger error is uncorrectable.

In the case of the data packet (DT), the data field contains transparent data supplied by the higher layer. The data field is not interpreted by the lower layer.

For control packets, the data field contains transparent or protocol related supervisory data. Table I provides a list of packet types.

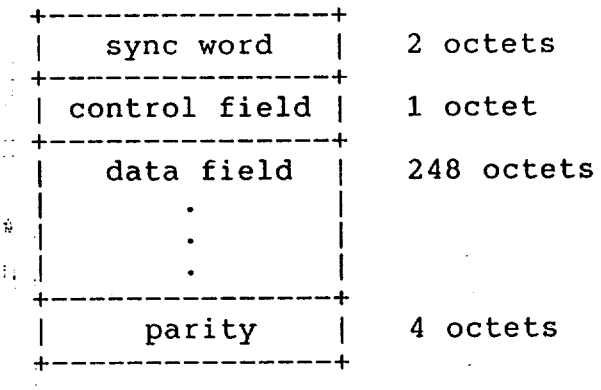

Figure 2. Lower layer fixed length packet format.

Acronym	Name	Control	Data
PD	Parameter declaration	x	
PC	Parameter confirm	x	
RD	Reset parameter declaration	x	
RC	Reset parameter confirm	x	
DD	Disconnect declaration	x	
DC	Disconnect confirm	x	
BR	Broadcast	x	
DT	Sequenced data		x

Table I. List of packet types.

3 PROCEDURE FOR TWO-WAY COMMUNICATION

For two-way communication, there are three procedures to be invoked:

- o Procedure for session parameter negotiation.
- o Procedure for session clearing.
- o Procedure for sequenced data transfer.

3.1 Procedure For Parameter Negotiation

When the physical connection has been established, the parameter negotiation is performed. Control packets PD, PC, RD, and RC are used in this procedure.

In the parameter negotiation phase, the two correspondent DTEs send each other PD (parameter declaration) packets. The PD packet contains the following information:

- Version number for communications procedure
- Number of physical connections
- Version number for video and audio coding algorithms
- Encryption information
- Other information on configuration and capabilities

Each DTE will continue to send PD packets at regular intervals until a PC (parameter confirm) packet is received. If a PD packet is received, and it indicates that the DTEs can communicate without defaulting to lower versions, the DTE sends a PC packet as a positive acknowledgement and keeps waiting for a PC packet from the other DTE.

If the received PD packet indicates that the other DTE must use a lower version number, the DTE starts sending RD (reset declaration) packets until the RC (reset confirm) packet is received from the other DTE. Then, it sends PD packets indicating capabilities that both DTEs can handle until a PC packet is received.

The parameter negotiation is completed when both DTEs have exchanged PD packets and received PC packets on each channel in use (one or two).

3.2 Procedure For Session Clearing

During the parameter negotiation or data transfer phase, either DTE can abort or clear the session by sending a DD (disconnect declaration) packet. This packet specifies the reason for clearing as its single parameter. The receiving DTE responds with a DC (disconnect confirm) packet.

3.3 Procedure For Sequenced Data Transfer

When the data transfer phase is entered, the sending DTE may commence transmission of sequenced data packets. Data from the higher layer is buffered into the data field in the packet. If encryption was selected for the session, the data field will be encrypted. The packet is tagged with a sequence number and sent out on the channel with the least number of buffered packets. The first packet to be sent has sequence number zero. Successively sent packets are marked with sequence numbers which are incremented by one modulo 128.

The receiving DTE will perform error correction and, for the two channel case, reorder incoming packets via the send sequence number. As there may be a delay between channels, packets from one channel may have to be buffered temporarily before processing. Packets are eventually processed by conditionally decrypting and then depacketizing the contents of the packet data field. The transparent data is sent to the higher layer.

If uncorrectable receive errors are encountered or packet dropout is detected via a missing send sequence number, any buffered receive packets are discarded and the higher layer is signalled. The receiving DTE will then just start looking for the next packet in the receive stream without regard for the sequence number. Care must be taken in the two channel case, as the new next packet to receive can be delayed in transmission relative to the other channel. Note that first sequence number expected upon entering the data phase is zero.

4 MULTIPOINT OPERATION

In a multipoint session, the parameter negotiation procedure is replaced by periodic retransmission of a broadcast packet (BR) by the current broadcaster. The format of data within the BR packet is identical to that of a PD packet. On reception of a BR packet, a listener on the network will begin to accept incoming DT packets if the BR packet from the broadcaster indicates compatible capabilities with those of the listener. No response is given on reception of a BR

packet. Broadcaster selection and determination of network arrangement (two-way vs. multipoint) is not handled at this level.