ITU Telecommunication Standardization Study Group 15

DOCUMENT: AVC-812

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

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1.

Introduction

1.1. General

This Submission is part of a group of submissions relevant to the H.323 standards. We have chosen to break out our recommendations into several discrete Submissions, where each Submission is focused on a specific topic, but with an eye to the whole. The list of RADVision's Submissions includes:

AVC-810 Numbering and Addressing System for H.323 Terminals and Gateways
AVC-811 Defining Session ID for H.323
AVC-812 H.22z Frame and LAN packet (the current submission)
AVC-813 Requirements for H.Signalling Recommendation within the scope of H.323
AVC-814 Providing Quality of Service on NGQoS LANs/H.323
AVC-815 RTP/RTCP use for H.22z
AVC-816 Video Payload for the H.22z

1.2. Current H.22z Draft

The current H.22z Draft relies heavily on RTP and has adopted the RTP Packet as the basic building block. The outcome of this adoption is that multiple unicast (one way) LAN connections are opened for every H.323 conference, and a relatively large number of LAN packets are generated.

To quote from the H.22z Draft:

"The general approach of H.22Z is to provide a means of synchronizing packets that makes use of the underlying LAN facilities. H.22Z is not a "multiplex" and does not attempt to pack all media and control into a single stream, which is then packetized....."

"Note that audio/video and call setup/control are never sent on the same LAN connection, and do not share a common PDU structure. Audio and video are sent to separate LAN ports using separate instances of RTP to allow for media-specific frame sequence numbers....."

"........Thus, the typical point-to-point, or point-to-gateway link can be expected to have at least three (and up to seven if MLP is used) LAN ports."

We consider that sending unnecessarilly large number of packets to be a major design flaw. The current specification draft should be modified to provide multiplexing.

1.3. Purpose of Document

This AVC is a proposal for a new basic format of the H.22z structure. We are proposing a change with regards to H.22z Rev3 (August 95) by defining a new entity - "H.22z Frame". The change is not semantic, because we propose that the H.22z Frame be defined as a multiplexing structure that may combine multiple PDUs from different Channels (as defined by H.245) which are all part of the same Session (see AVC 811) into a single H.22z Frame.

2. A Technical Discussion

The aim of the H.323 is to provide robust communications for Videoconferencing over LANs. Since this requirement is non-trivial (as LANs were not designed to handle real time traffic), H.323 should be designed so as to provide the best possible performance on existing LANs.

Most LANs are shared access networks. Multiple users are sending multiple concurrent data streams via the same pipe. Shared access / shared resources networks suffer from performance degradation due to congestion.

It is important that H.323/22z be designed in a way that minimizes congestion, provided other performance parameters are not sacrificed.

2.1. Congestion due to Bandwidth Requirements

A 128kbps Videoconferencing session (with some control overhead) consumes 300kbps of the LAN bandwidth, i.e. 3% of 10 Base T Ethernet and 2% of 16MBPS token ring.

The reality though is that since the data is sent in packets, there is overhead. The header of a RTP/UDP/IP packet running on Ethernet is about 110 bytes.

If 100 packets are sent every second, the bandwidth taken by the overhead is 100x110x8bps = 88kbps (i.e. another .9% of the total Ethernet bandwidth).

Total bandwidth of a single 128kbps session will be about 4%. Net payload is 75%.

If Audio, Video, Data and Control were sent separately, a 128kbps session might create more than 500 packets per second. The same conference will now 500x110x8bps = 440kbps of overhead (4.4%). Total bandwidth per session will now be 7.4%, and the net payload will be less than 50%.

Conclusion; Reduce the number of packet, and reduce the bandwidth required.

2.2. Packet Handling

Unnecessary congestion on a LAN can be created when an application generates too many short packets. The load is due to two factors:

a. Physical Layer - i.e. collisions on Ethernet. The more packets that are trying to access the LAN, the more collisions, and the lower the effective throughput.

LAN Administrators know from experience, that if their LAN is congested, they will improve performance if the LAN connected devices can generate longer packets.

b. Link and Transport Layer devices like Bridges, Routers, Switches (and now Gateways) are all required to process packets. For all practical purposes, the processing and buffering required is independent of packet length. The more packets, the higher the load on the Router. Routers and Bridges tend to drop packets under heavy loads.

Experience has shown that packet overload is a major factor in driving down the effective LAN throughput.

2.3. Conclusion

H.22z should be designed to minimize the number of packets that are to be transmitted, provided however, that the delay is not increased appreciably. The mechanism that can provide the solution is multiplexing; combining multiple PDUs from different Logical Channels into a single Frame.

3. Proposed H.22z Frame

3.1. VCP STACK

The following is the structure of an Ethernet packet. Each packet includes header, data portion and trailer. The data portion is between 46 to 1500 bytes .

MAC HEADER	DATA	MAC TRAILER

The Data of the Ethernet packet contains the IP header and the IP data. The IP header is 24 Bytes (without options), leaving 22 to 1478 Bytes for IP data.

MAC HEADER	IP HEADER	DATA	MAC TRAILER

The IP data contains UDP header and Data . The UDP header is 12 Bytes leaving the DATA to be between 10 to 1466 Bytes.

MAC HEADER	IP HEADER	TCP/UDP HEADER	DATA	MAC TRAILER

The TCP or UDP data contains the H.22z Header and Data.

The use of UDP for information packets as unreliable protocol is selected to reduce the overhead of TCP as reliable protocol. The TCP is used for control packets to ensure reliability.

MAC HEADER	IP HEADER	TCP/UDP HEADER	H.22z HEADER	DATA	MAC TRAILER

3.2. H.22z HEADER

The VideoConference Protocol is based on the following assumptions:

a. Audiovisual data is transmitted in both directions or one direction only (Multicast) at a fairly constant rate.
b. Audio and Video information is less sensitive to errors than Data and Control.

Based on the assumption (a) there is no need for special acknowledgment packets. The information (data) packet may include status & control information (feedback). In Multicast or broadcast sessions it may be that audiovisual information is unidirectional. In this case packets in the other direction include status & control information only when necessary. The protocol is quasi-reliable. The packets are numbered in a sequential order and it is possible to send new packets even if an acknowledgment is not received. The status returned from the destination specify which packets (by sequence number) were received.

The following is the structure of the H.22z part of the packet.

VERSION (4)	TYPE (4)	DATA

3.2.1. H.22z Frame Format

Version (4)	Frame Type (4)	Frame Index (4)	Number of PDUs (4)	Session Id (4)	Acknowledge Status (24)	Reserved (8)	PDU 1 Header (20)	.....	PDU n Header (20)	PDU 1 Data (m_1)	..

Version - Indicates the version of the VCP

FrameType -

Frame index - sequential number from the beginning of a session

Number of PDUs- defines the number of PDUsin the Frame

Session Id - 4 Bytes for IP address of the originator and 4 Bytes for sequence.

Acknowledge Status (Optional)

Number of Frame (4)	Frame 1 (4)	Frame 2 (4)	Frame 3 (4)	Frame 4 (4)	Frame 5 (4)

Number of Frames- The number of Frames in the acknowledge status (between 0 to 5)

Frame 1 - Frame 5 - The Frame index of the Frames received at the other side