Video Codec Requirements
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Abstract

   This document provides specific requirements for an Internet video
   codec. These requirements address quality, bit-rate, and packet-loss
   robustness, as well as other desirable properties.

Status of This Memo

   This Internet-Draft is submitted in full conformance with the
   provisions of BCP 78 and BCP 79.

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   time. It is inappropriate to use Internet-Drafts as reference
   material or to cite them other than as "work in progress."

   This Internet-Draft will expire on September 10, 2015.

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1. Introduction

   This document provides requirements for a video codec designed
   specifically for use over the Internet. The requirements attempt to
   address the needs of the most common streaming and interactive video
   transmission applications and ensure good quality when operating in
   typical Internet conditions. These requirements also address issues
   of quality, frame rate, bit-rate, and packet-loss robustness. Other
   desirable but not required video codec properties are also
   considered.

2. Applications

   The following applications should be considered for Internet video
   codecs, along with their requirements:

   o Point-to-point calls

   o Broadcast

   o Conferencing

   o Telepresence

   o Teleoperation

   o Screencasting

   o In-game video chat

   o Video storage

   o Other applications

2.1. Point-to-Point Calls

   One-to-one video chat applications are proliferating. These
   interactive uses of a video codec involve two connected participants
   sending and receiving encoded video to each other. Frame sizes will
   typically be 360p to 720p and bandwidth used around 1 Mbit/s.

   The endpoints will need to negotiate and change session details
   during the call. For example, one endpoint may request higher
   resolution video when the size of the display window is increased.

2.2. Broadcast

   Broadcasting is live or pre-recorded video being sent to many
   participants at the same time. This will typically involve frame
   sizes up to 1080p and bandwidth requirements as high as 6 Mbit/s.

   Example applications in this area include on-demand video service
   like Netflix and YouTube as well as digital transmission of live
   sporting events.

2.3. Conferencing

   Video conferencing requires many of the same things as point-to-point
   calls, but involves more than 2 participants. It is more complicated
   due to the shifting focus of attention among the participants. For
   example, when one participant is speaking, the user may prefer to
   have their video appear larger and the other participants smaller,
   which may have consequences for codec parameters.

   Frame sizes and bitrates are similar to point-to-point applications.

2.4. Telepresence

   Telepresence tries to use high fidelity reproduction to make remote
   video conference participants feel like they are real people in the
   same room. This requires high resolutions and large amounts of
   bandwidth. It is otherwise very similar to video conferencing
   applications.

2.5. Teleoperation

Teleoperation requires the high fidelity of telepresence, but
includes increased requirements for low latency. Remote control of
surgical tools is one example application.

[2.6](). Screencasting

Screencasting is the sharing of the contents of some or all of a
computer or mobile display. It is commonly used to send the visual
output of applications to other endpoints. For example, a speaker at
a conference might share the window for their presentation program
and a mobile app developer might want to record a demo of their
application.

Two main features distinguish this application. First, since the
inputs are often RGB, it is important to preserve the color
information at a higher fidelity than normal video. Second, the
input for the encoder is potentially higher level than raw pixels or
contains both pixels and higher level objects such as text along with
font and positioning information.

[2.7](). Video Storage

Archival video brings several unique requirements. Many applications
will want lossless compression or very high rates, and others will
want low complexity. Examples of the former include archival storage
of film masters; examples of the latter would be surveillance gear or
video camera capture systems.

[2.8](). Other Applications

The preceding list of application is by no means complete. The
requirements needed to enable these applications should be sufficient
to meet the needs of many other applications that were not listed.

[3](). Constraints Imposed by the Internet on the Codec

o must be able to interpret packets when previous packets are lost

o prediction across frames is reasonable but must allow for resync

o keyframes and other features for dynamic resync

o ability to vary bandwidth because of internet best-effort

o ECN

o use with other multimedia standards

[4](#). **Detailed Basic Requirements**

   o variable frame rate

   o variable resolution

   o any resolution from 1x1 to 4k?

   o 8bit to 12bit

   o loss robustness

   o loss concealment?

   o error recovery

   o 420, 444, 422

   o color spaces: req 709 and 2020

   o alpha plane

   o parallelism considerations (entropy coder in separate thread,
      wavefront parallel, etc.)

   o hardware feasibility

   o software feasibility

   explicit non-requirements:

   o multiview

   o scalable video coding

   o bit-error robustness

[5](#). **Additional Considerations**

   The features described in this section are potentially desirable but
   are not part of the strict requirements. Their benefits should be
   weighed against their costs before including them in the codec.

   o lossless

   o RGB mode

   o aux planes (depth, etc.)

6. **Security Considerations**

   Although this document itself does not have security considerations,
   this section describes the security requirements for the codec.

   As for any protocol to be used over the Internet, security is a very
   important aspect to consider. This goes beyond the obvious
   considerations of preventing buffer overflows and similar attacks
   that can lead to denial-of-service (DoS) or remote code execution.
   One very important security aspect is to make sure that the decoders
   have a bounded and reasonable worst-case complexity. This prevents
   an attacker from causing a DoS by sending packets that are specially
   crafted to take a very long (or infinite) time to decode.

7. **References**

Authors' Addresses

   Jack Moffitt
   Mozilla

   Email: jack@metajack.im

   Mo Zanaty
   Cisco

   Email: mzanaty@cisco.com