RUcore
Rutgers Community Repository

Introduction

This document will set forth a standards recommendation for moving images and digital video. In particular, this video object standard will recommend specific file formats for the preservation master and derivatives, for implementation into the Rutgers Community Repository (RUcore) and projects using similar architectures, as well as recommend sampling rates and specifications for presentation derivatives.

As with all other standard types established thus far, it will be mandatory to store and preserve an archival master, to ensure an object of the highest available quality is maintained for digital preservation. Additionally, one or more downsampled and compressed presentations copies will be made available for end users wishing to access these objects online. These presentation copies are to be stored and accessible in formats that users will find easy to play back, and will use file formats and codecs that are compatible with multiple computer platforms, using established industry standards.

Sampling and Digitization Rationale

The handling and preservation of digitized moving images presents a unique challenge to digital repositories. Presently, uncompressed digital video demands an extremely large amount of storage space, and produces incredibly large files. Yet, the need to store an uncompressed or reliable lossless-compressed object is paramount to ensure its longevity. While it is recognized that work continues in perfecting lossless video compression standards, we feel that these codecs are not mature enough and have not yet reached a critical mass in terms of user base and supporting software to implement in place of an uncompressed stream. We remain open to revisiting this stance in the future.

We also recognize with the growing convergence of digital devices, and the prevalence of smaller video capture equipment, there will be an increasing amount of digital content which is born in a compressed digital format. Such cases will pose long-term preservation challenges depending on the file times, video codecs, resolution and compression levels used. When such video is slated for inclusion into RUcore, a case-by-case condition analysis will occur; best efforts will be made to store the native format as an archival datastream; and when necessary, a converted copy into a designated stable format will also be stored with the archival datastream.

In spite of the present need to store an uncompressed stream when digitizing from an analog master, it is obvious that delivering such an object to end users would be impractical given current average connection speeds. Consequently, there is an additional need for downsampled, compressed presentation formats for video objects, more than any other object type addressed by the repository.

As always, the guidelines presented here are recommendations, and there may be cases where judgment calls will need to be made about objects that would be better preserved by modifying the recommended guidelines for this purpose. In particular, the digitization team has not yet digitized film archives, and as such those formats will need to be analyzed for the best possible digitization settings. The Digital Data Curator, as well as the Digital Preservation Task Force, should be consulted for guidance when such adaptations are required.

Recommended Standards for NJDH and RUcore Video Digitization

For analog preservation masters (when possible):
File format: *Uncompressed, Full Frame Video (AVI file format) or DV Source for digital video.*

Frame rate for analog Standard Definition (SD) video, NTSC: *29.97 frames per second, 640 x 480 resolution (assuming square pixels). 4:2:2 quantization, 25MiB/s data rate.*
We recognize this sampling scheme as the best practical standard to ensure a good preservation master of analog SD video archives, and will be the most common digitization sampling rate for objects that come to us as SD analog video. This standard is based on our experiences with digitizing videotaped objects.

For Digital objects (i.e. DV/HDV), including high definition video: *Use and preserve same frame rate, resolution and bit rate as the original.*
For born-digital video objects such as DV or MPEG-2, the logical course of action is to preserve the exact specifications of the original. It will not be wise to downsample the original as that will cause a loss of object data, and no improvement in quality will be gained from upsampling.

All other objects: Make best effort to preserve frame rate and resolution of the original content. The goal in digitizing the various analog formats that may come to us will be to create a digital master file that preserves the content of the analog original as accurately as the digital media permits. A wide degree of flexibility and some experimentation may be required to determine accurate settings for each unique case.

Presentation video files:

- **One streaming/progressive downloadable video clip:**
    - **MPEG-4 H.264 video (.MOV, .M4V, .MP4), encoded for hinted streaming**
    - For 4:3 – Minimum of **640 x 480 resolution (square pixels), 30 frames per second, multi-pass encoding**
    - For 16:9 - Minimum of **854 x 480 resolution (square pixels), 30 frames per second, multi-pass encoding**
    - Recommended Data rate of **640 kbps minimum, and up to 860 kbps.**
      Use higher bitrates for videos with more detail and greater motion.
    - **Key frames inserted every 30 frames at minimum, or auto-select. This rate should be adjusted when necessary for best results.**

    This recommendation is aimed at balancing the file size, and the amount of bandwidth required to play the video, while trying not to sacrifice video quality. This specification necessitates the use of a broadband internet connection, but is configured so that basic Home DSL or casual WiFi users should still be able to view the content.

    MPEG-4 Video, particularly MP4, is cross-platform and can be accessed by desktop computer users of varying operating systems (Windows, Mac, Linux), using free software and established web standards. H.264 video is also viewable on a multitude of internet-connected mobile devices.

    Starting in late 2010, the MP4 container format is recommended, as this format permits us to use a single H.264 video file to provide service for mobile devices as well as progressive download and streamed video.

Progressive download standard for older objects

Prior to September 2010, the standard for progressive-download presentations videos were as follows, but has since been deprecated with the use of the single-source MP4 spec listed above:

- **If permissions permit: one progressive-download video clip**
  - **Flash Video Format (.FLV), using ON2VP6 Codec**
  - For 4:3 – Minimum of **640 x 480 resolution (square pixels), 30 frames per second, multi-pass encoding**
  - For 16:9 - Minimum of **854 x 480 resolution (square pixels), 30 frames per second, multi-pass encoding**
  - Data rate of **512 kbps**
  - **Key frames inserted every 30 frames. This rate should be adjusted when necessary.**

  Our experimentation has shown these output settings to be an ideal compromise, producing a clip viewable at acceptable quality on a computer screen while providing a reasonably manageable file size. Users choosing to view this format will need to download the latest version of a free Macromedia Flash Plug-in, provided by Adobe Systems, Inc.